MODERN PLASTICS

JANUARY 1954

PROGRESS IN 1953
PROSPECTS FOR 1954

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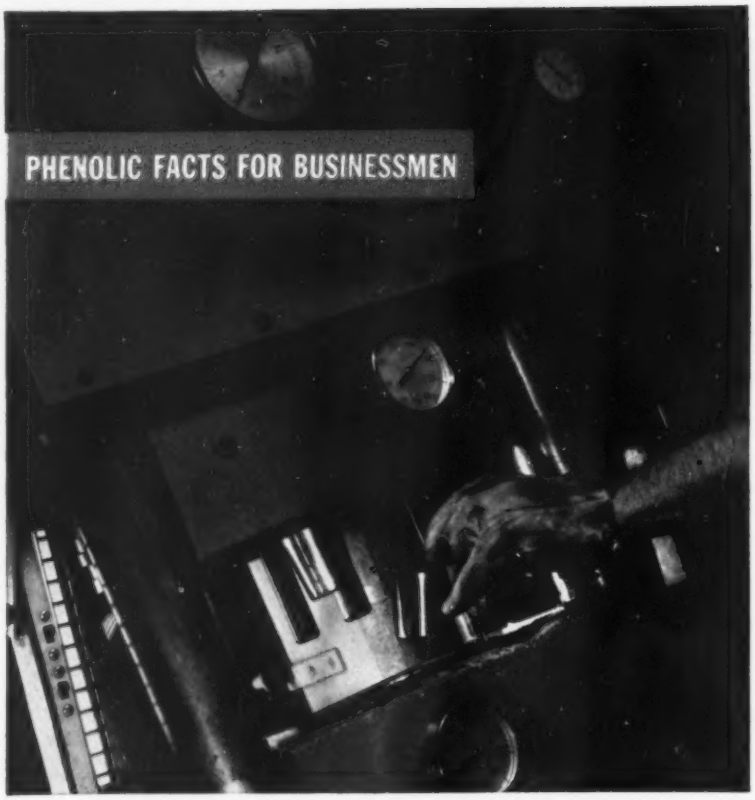

Ever see your reputation close-up?

● We see ours every day. Indeed we make such a point of it that, when no press meeting our standards for examining the flow value of plastics was available, we designed this new type ourselves. The test pieces it turns out are part of the quality control program on which the Durez reputation rides.

Assuring the highest possible uniformity from batch to batch, this press is one of the many behind-the-scene reasons why thousands of manufacturers put their faith in Durez phenolic resins and molding compounds. Others include Durez laboratories full of experimental and testing apparatus and groups of hard-to-please men.

So when *you* lay your company's reputation on the line with Durez materials, you may be sure there are no better of their type. We've been specializing in the phenolics — most versatile of all plastics — for 32 years. We'll gladly work with your molder or your own staff in applying them profitably to your needs.

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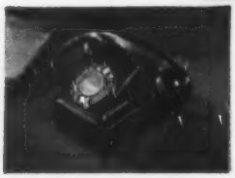
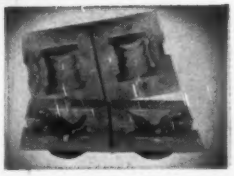
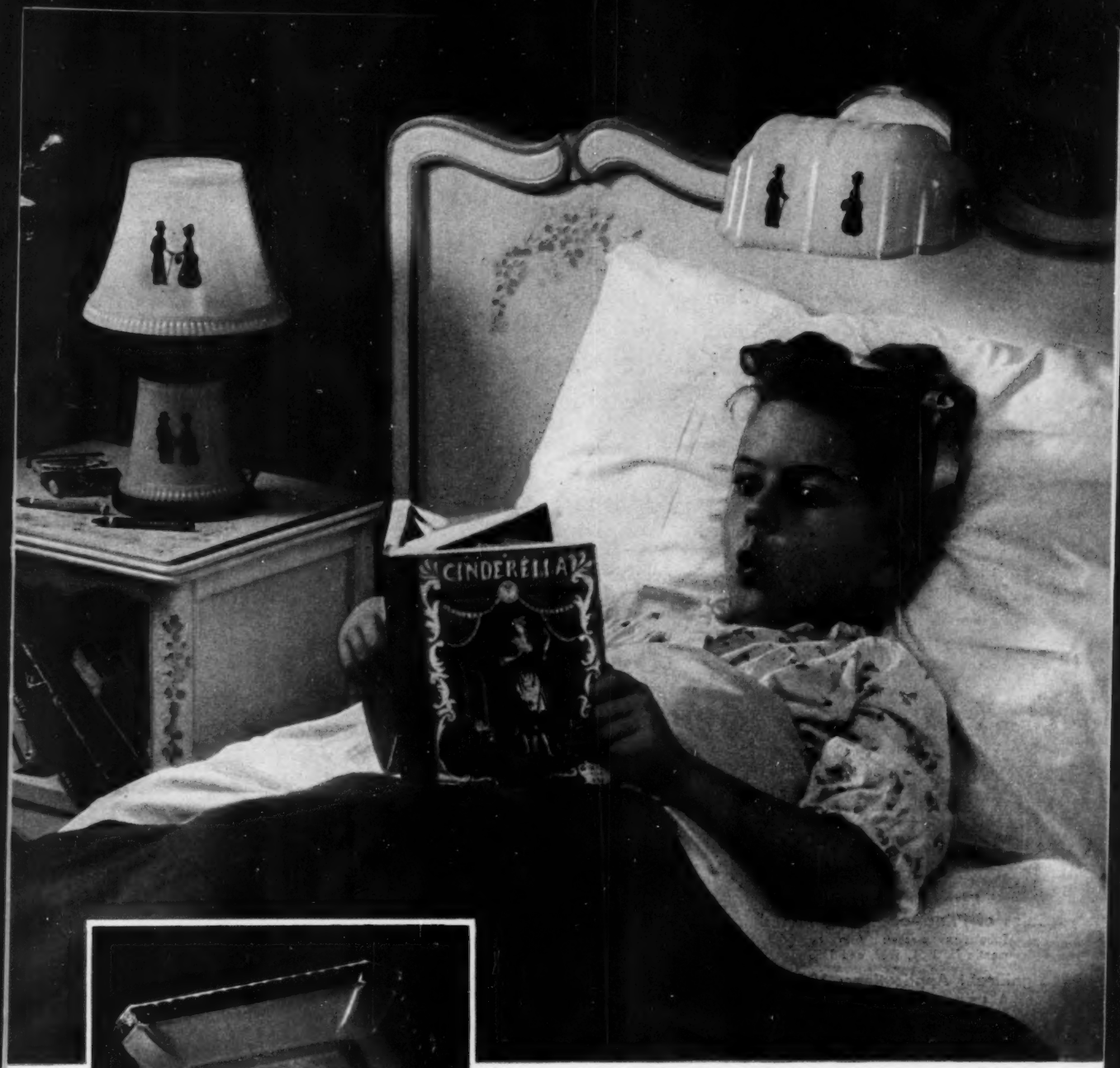


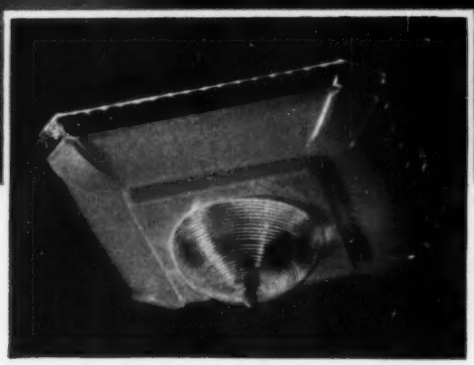
MOLDING COMPOUNDS
—familiar in thousands of products built for rugged everyday service

RESINS FOR INDUSTRY
—including a new fast curing type for shell molding in foundries



PHENOLIC PLASTICS THAT FIT THE JOB





For *light* reading, little Cinderella's Prince Charming is CATALIN *Styrene*

A child's boudoir is the Queen's palace, or the King's castle . . . So that young dreams and fantasies encourage happy realities, the good Mother Fairy is careful, in selecting for it, only the most cheerful appointments. To achieve pretty lamp settings, the "Good Knight", in the story, recommends her to the name REX*. "This company's very special lamps and fixtures", he whispers, "are molded for you of a dream-inspiring material—CATALIN STYRENE—the gem of plastics!"

"The matching bed lamp and table lamp, pictured, are selectable in pink, ivory and chartreuse CATALIN STYRENE. The 'jiffy clip-on' ceiling fixture comes in crystal-accentuated pink, and five other beautiful CATALIN STYRENE colors."

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MODERN PLASTICS*

January 1954 • Vol. 31, No. 5

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*Reg. U.S. Pat. Office.

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Co. supplies only the Geon polyvinyl chloride compound for the drain rail.

KING-SIZE MOLDED VINYL "RUN-OFF" improves freezer unit efficiency

PICTURED here is another new use for Geon polyvinyl resin—one that shows how readily adaptable Geon is to unusual requirements.

It's a flexible drain rail for conveying defrosted water from a freezer unit—one of the largest, injected molded vinyl parts ever made. It not only provides a trouble-free means of carrying off defrosted water to the drain pan, but has many extra advantages.

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The unusually large size of this drain rail illustrates the many possibilities for injection molding with Geon vinyl compounds. It measures 4½ feet from tip to tip and nearly 2 inches in width, weighs 21½ ounces. Installation in the refrigerator is a simple operation.

You may get an idea from this of how a Geon material can help you improve or develop more saleable products. Geon materials can make products flexible *or* rigid, transparent or opaque. They have helped solve many problems—and build sales for such products as tablecloths, curtains, flooring, wire insulation, gaskets and many more products for home and industry. We'll help you select the Geon material best suited to your needs. For information, please write Department GB-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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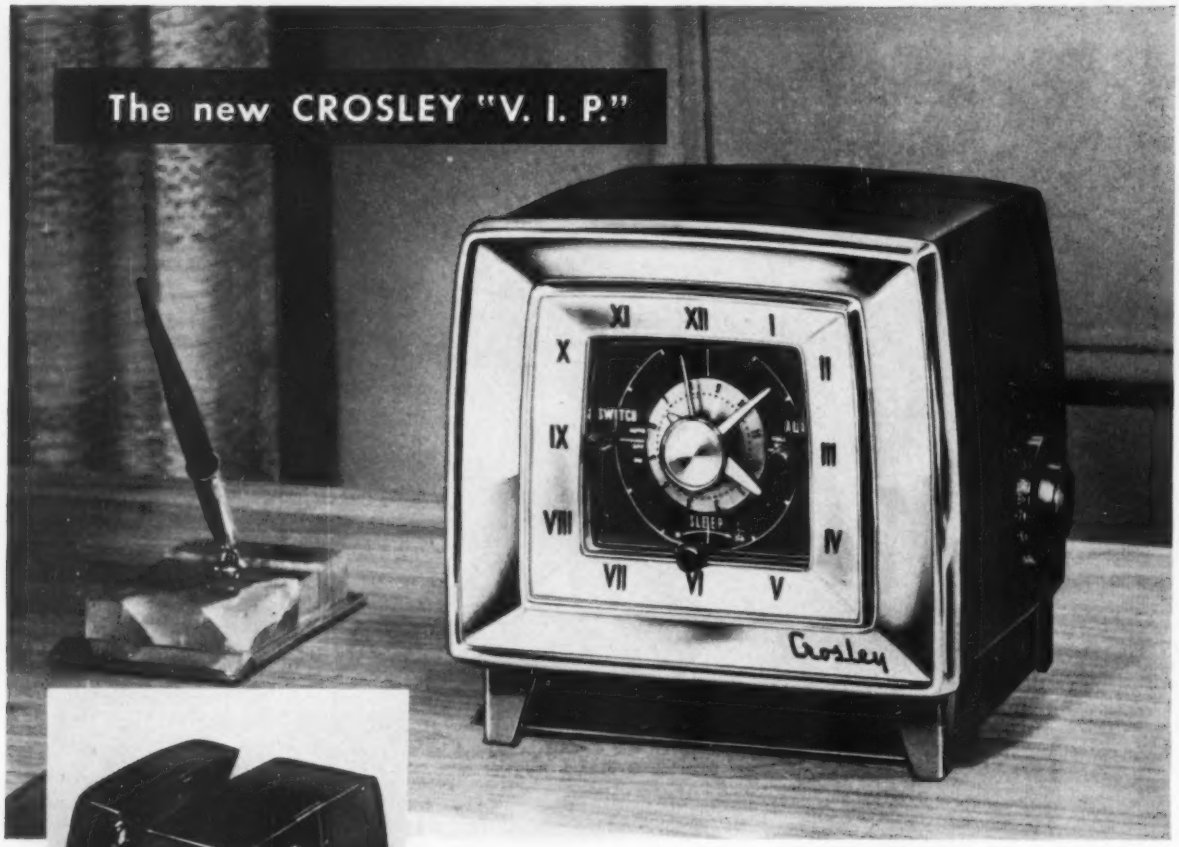

The three matching plastic parts that make up the complete housing.

WHY CROSLEY SPECIFIED
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According to Crosley, "V. I. P." stands for a "Very Important Product" for "Very Important People." However, it also stands for "Very Intricate Production." If you look inside the handsome molded plastic housing you'll see what we mean.

There are three matching parts . . . with undercuts, flanges, bosses, slots and side openings. It was obvious at the outset that the new Crosley "V. I. P." would require the finest molding talent, experience and facilities available. So . . . Chicago Molded was called in.

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EDITORIAL

Better Building Codes

From its earliest inceptions, the plastics industry has been plagued continually by habit and tradition in the construction field. It is easy to understand why architects and builders are loathe to accept "new" materials. First, a material must be tried and tested over a period of years before it may be recommended for a building application, because construction financing is of a long-term nature and buildings and their components must last for decades. Second, the historic skills in the construction field do not lend themselves readily to the use of new materials.

In spite of these impediments to the marketing of plastics in the building field, great progress has been made. In the case of styrene wall tile, first progress was made through the "do-it-yourself" market for home remodeling; the professional tile setter was sold later. Here, however, negative publicity concerning flammability of plastics had to be combatted by presentations before FHA officials, fire marshals, etc. Commercial Standard 168-50 on styrene plastic wall tile, promulgated through the Department of Commerce by the tile industry, has done much to overcome this negative publicity. In the case of vinyl floor tile, the main problem was to make it so that men used to laying other types of resilient flooring could handle vinyl.

For several years, acrylic has been promoted in sheet form for various types of construction, including partitioning, glazing, illumination, and sky-lighting. Work has been done on both the local level with the Building Codes of individual communities and on the national level with the Building Officials Conference of America. And, today, acrylic materials are widely accepted within the limits of their properties.

The makers of phenolic-melamine decorative laminates have similarly built themselves a position of prestige among those responsible for the establishment of building codes.

Now the manufacturers of polyester-fibrous glass sheeting are moving in the same direction. First bright light on the horizon is from Los Angeles where the very modern building code has been revised to include both thermoplastics and reinforced thermoset materials for structural use, putting plastics on the same selective footing as traditional materials such as plaster, wood, brick, metal, and glass. In addition, conferences are currently being held between the SPI Corrugated Panel Committee and the Code Changes Committee of BOCA, with a view to encouraging local as well as national building officials to embrace these new and valuable plastics materials.

The way is long and hard, and makers of plastics materials for the construction field frequently find it necessary to fight skirmishes on local fronts because of local jobs. But, certainly, the best way to accomplish the total purpose of the industry is to present the proposition carefully at the national level, from which local building code authorities may be influenced to take basic direction.

In Plastics Reducing Machinery, Look to CUMBERLAND for the COMPLETE LINE

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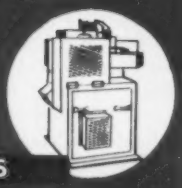


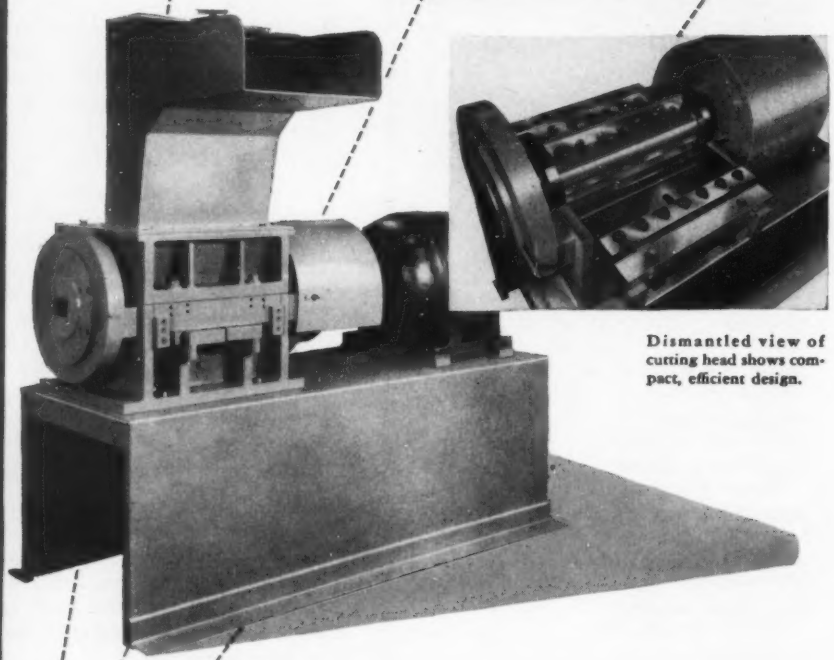
DICERS

CHOPPERS

PREBREAKERS

MODEL 20 All Steel Granulator

CUSTOM ENGINEERED QUALITY BUILT



Dismantled view of cutting head shows compact, efficient design.

1 HEAVY DUTY — Large flywheel—thick all-steel weldments—deep welds—parts are of flawless wrought steel (not steel castings)—machine resists wreckage.

2 LARGE THROAT OPENING — 8 by 20" size.

3 PRIOR BANDSAWING NOT NEEDED — Machine specially built to handle large chunky parts such as bleeder scrap, cylinder purgings and heavy cast slabs of polystyrene, modified polystyrene and acrylic resins.

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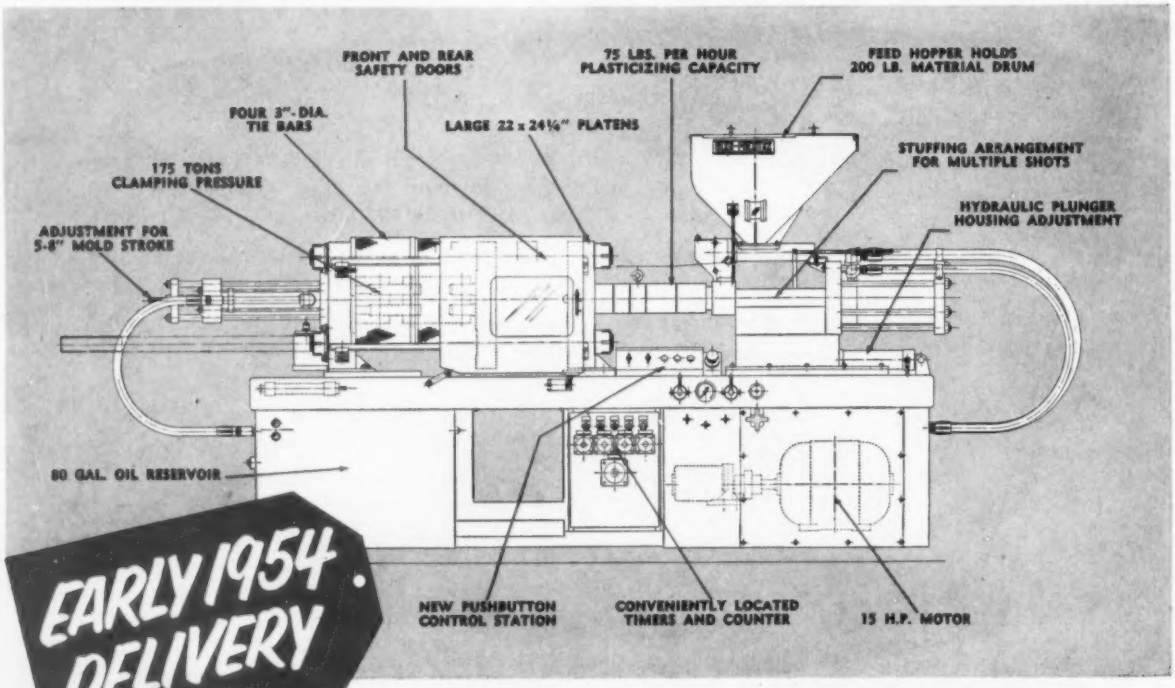
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Write today for literature on the new 175T-4/6 oz. machine and the special bulletin on "Fully Automatic Molding".

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Ranger, 14 ft.—Lone Star Boat Mfg. Co., Grand Prairie, Texas

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Two Marco developments helped spark this revolution in boat building: The Marco Molding Method that makes possible the one-piece molding of hulls up to 36 ft. in length and even longer—in production... and Marcothix† the liquid resin that acts like a solid—permitting faster production speed in hand-lay-up fabrication. Marcothix does not drain from vertical surfaces. It produces boat hulls with consistent thickness and uniform resin penetration from gunwale to keel!

THE FIRST STRUCTURAL PLASTIC

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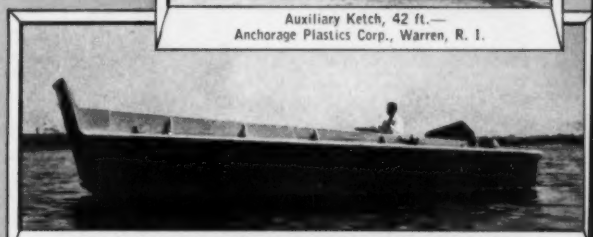
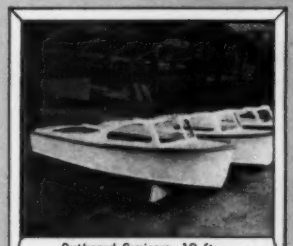
Auxiliary Ketch, 42 ft.—
Anchorage Plastics Corp., Warren, R. I.



LCVP, 36 ft. (experimental)—Palmer Scott & Co., New Bedford, Mass.



Outboard Cruisers, 18 ft.—
Palmer Scott & Co., New Bedford, Mass.

Panther Runabout, 14½ ft.—
Herblin Corp., Port Washington, N. Y.

Rebel, 16 ft.—Ray Greene & Co., Toledo, Ohio

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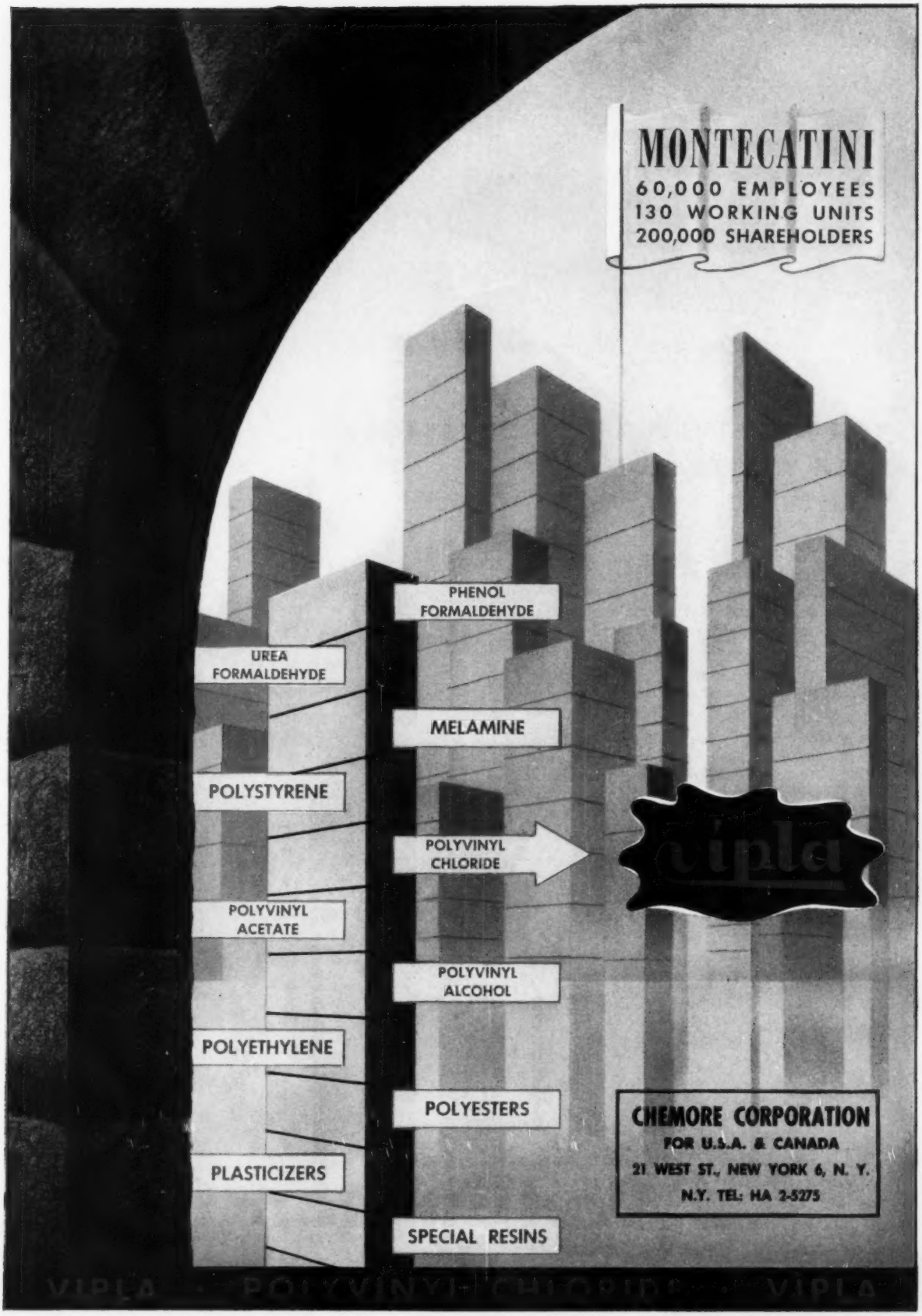
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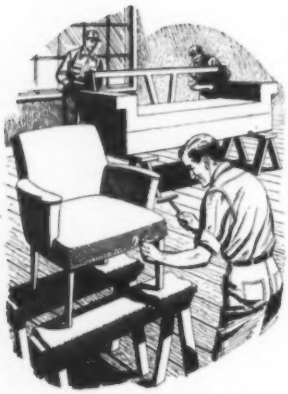

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"Columbus" cotton sheeting is widely used for coatings demanding high quality, flexibility, easy handling, and an absolute minimum of production rejects.

YOU GET STYLING PLUS DURABILITY WITH WELLINGTON SEARS "LANTUCK"

A "natural" for deeply embossed patterns, Lantuck non-woven fabric has been specially developed by Wellington Sears for vinyl coating. Its random fibers are bonded with a specifically selected heat-sensitive resin which affords complete fusion with vinyl for easy molding and shape retention.

In addition to embossability, Lantuck features true multi-directional strength because of its completely random distribution of fibers.

Lantuck may be calender coated, laminated or electronically sealed to vinyl film. Highly flexible, it provides smooth surface and high gauge-weight ratio at reasonable cost. Stitch and tear strength is improved without interfering with the vinyl film's soft, pliable hand, so important in upholstery, auto seat covers and the like.

Lantuck for coating is available in 54 to 56 inch width in weights of about 3 to 4 ounces per square yard. For further facts—including development work now in process—contact our nearest sales office.

Write for a free copy of "Modern Textiles for Industry" which includes pertinent information on fabric-and-plastic applications. Address: Wellington Sears, Dept. 1041, 65 Worth Street, New York 13, N. Y.

Superior Fabrics for Coating and Laminating

- Single filling ducks
- Army ducks
- Single and plied-yarn chafers
- Special ducks
- Sateens
- Twills
- Broken twills
- Drills
- Sheetings
- Nylon, rayon, Orlon* and other synthetics
- Lantuck non-woven fabrics

*DuPont's trademark for its acrylic fiber

Wellington Sears

A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

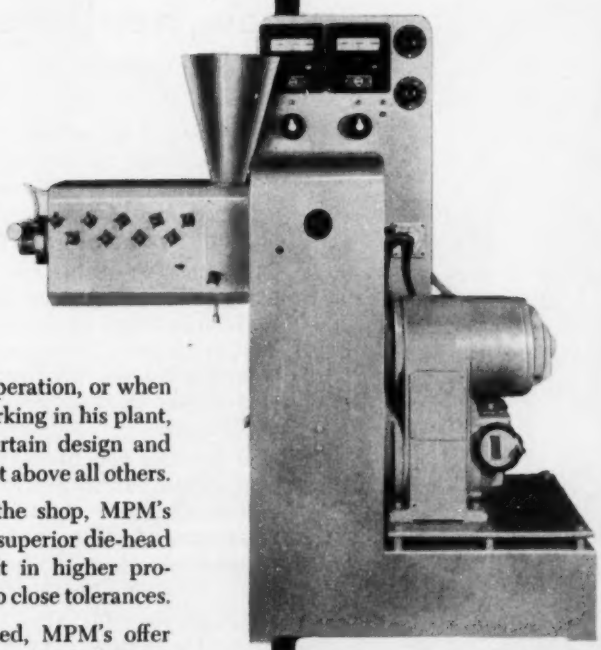
FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

Offices In: Atlanta • Boston • Chicago • Detroit • Los Angeles • New Orleans • Philadelphia • San Francisco • St. Louis

Don't believe them when they say:

It's built just like an MPM



This is the 1½" MPM extruder. Other sizes available are 2½", 3½", and 4½". MPM also supplies auxiliary equipment such as wind-ups for flat and blown film, wire covering, monofilaments, dryers, granulators, pelletizers and so forth.

Since all extrusion machines are basically alike, consisting of a motor, a hopper, heating devices, a screw, and a die-head... some people get the idea they all *perform* identically. Nothing could be further from the truth.

When you see an MPM extruder in operation, or when you question somebody who has one working in his plant, you will discover that an MPM has certain design and construction features which recommend it above all others.

From the viewpoint of the man in the shop, MPM's exceptional heating and cooling system, superior die-head construction, and powerful drive result in higher production of all manner of extrusions, held to close tolerances.

As far as plant owners are concerned, MPM's offer trouble-free operation, solid corrosion-resistant wearing parts which guarantee long service, and ***built-in*** flexibility, of great value now and of increasing value as new plastics materials are developed.

It's easy to be misled by superficial resemblances. Before deciding on an extruder for producing flat sheet, wide films, cross-sections, covered wire or some other item, investigate the high productive capacity and additional advantages for which MPM extruders are noted.

West Coast Representative
4113 West Jefferson St., Los Angeles 16, Calif.

modern plastic machinery corp. mpm

15 Union St. Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

TOUGHEST RESIN EVER-

new, heat-resistant Plio-Tuf

Whether you use a hammer or an Izod Impact Tester, you'll find you can't beat the unusually heat-resistant PLIO-TUF resins for toughness. And you'll also find these high styrene copolymers are hard, rigid, light in weight, light in color, low in water absorption and electrically and chemically resistant.

The PLIO-TUF resins are virgin resins—not blends with rubber. They can be used alone, blended with each other or dispersed in various rubbers to increase their hardness, tensile strength or heat resistance. These unique resins, and their blends, are easily compounded—do not require curing—can be mixed, calendered, extruded or molded on conventional rubber or plastics processing equipment.

The extreme toughness of the PLIO-TUF resins offers two outstanding advantages. First it permits you to meet impact resistance requirements previously beyond the range of all non-reinforced plastics. And second, it permits you to lower compound costs through the use of fillers, while still maintaining above average impact strength.

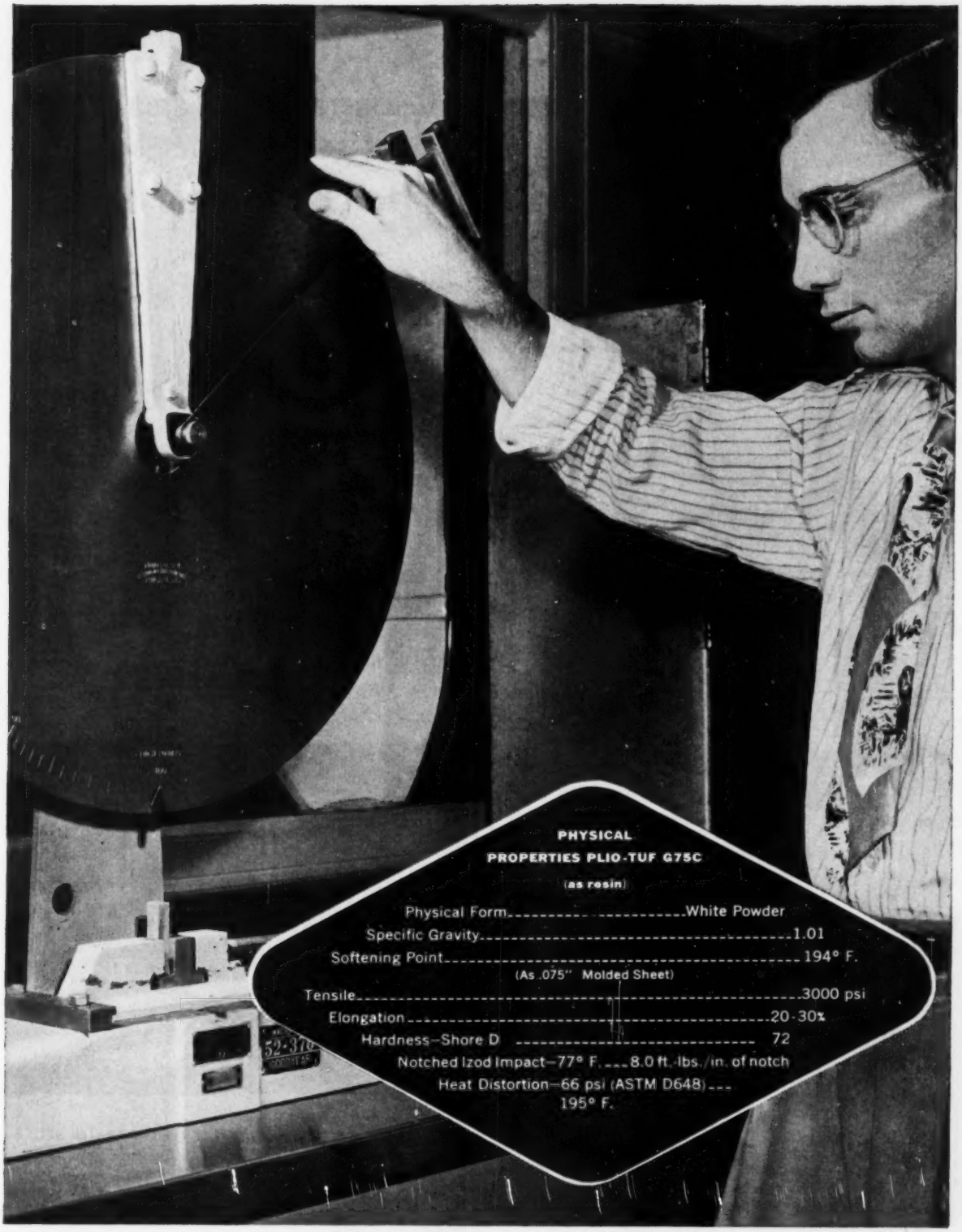
All in all, the unusual physical properties of the PLIO-TUF resins, coupled with their ease of processing and excellent working characteristics, offer intriguing possibilities for new products in new fields using existent equipment. Once compounded and preformed, they can be readily post-formed and drilled, punched, tapped, turned, sawed, sewed, cemented or otherwise fabricated and finished into an almost limitless number of items.

Samples, literature and full technical help on the PLIO-TUF resins are yours by writing to:

Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry


PHYSICAL
PROPERTIES PLIO-TUF G75C
(as resin)
Physical Form ..... White Powder
Specific Gravity 1.01
Softening Point ..... 194° F.
(As .075" Molded Sheet)
Tensile ..... 3000 psi
Elongation 20-30%
Hardness–Shore D 72
Notched Izod Impact–77° F. ... 8.0 ft.-lbs./in. of notch
Heat Distortion–66 psi (ASTM D648) ...
195° F.

SWINGING PENDULUM of this Izod Impact Tester points up the unmatched toughness of the PLIO-TUF resins, which is but one of their many unusual properties.

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

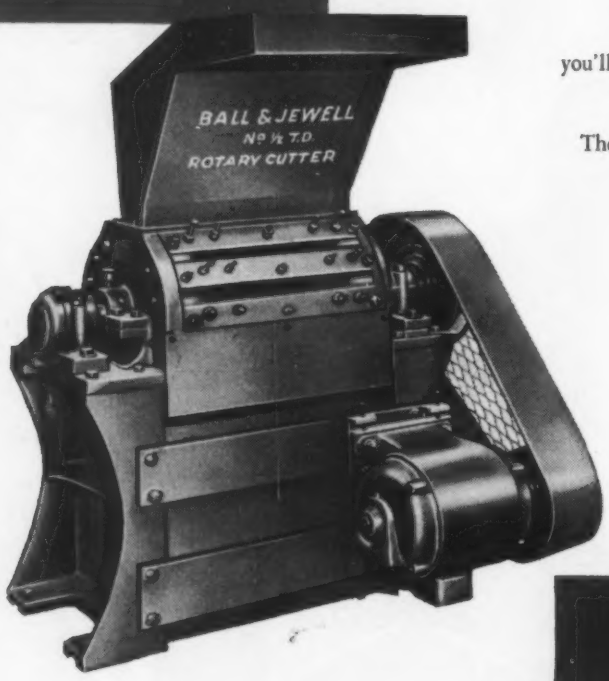
Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

No. ½ TD

MEDIUM CAPACITY GRANULATOR

Grinds accumulated scrap, large area rejects small purges and small bleeder scrap

UP TO 500 POUNDS AN HOUR



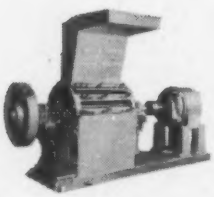
Wherever a tough, medium capacity grinder is needed, you'll find a B & J No. ½ TD. Hundreds are in use throughout the industry . . . for good reason. The B & J No. ½ TD has proven itself to be the best grinder in its class . . . providing high speed production, sturdy construction, and low-cost operation in a machine which occupies only 3'8" x 3'11" of floor area. V-belt driven, the No. ½ TD is powered by either a 7½ or 10 HP motor. The regular model has a 5½" x 20" throat opening which is sufficient for most needs. Where a larger throat opening is required, the No. ½ TD Model 451, with an 8" x 20" throat opening, is available.

No. ½ TD
EXCELLENT FOR RE-GRINDING TRIM SCRAP AND REJECTS OF VACUUM FORMED PARTS

Such as refrigerator panels, automotive panels, aircraft instrument panels, food trays, etc.

STANDARD IDEAL

3½"x10" throat opening. 2 or 3 HP motor. Capacity up to 250 lbs. an hour.



No. 1

7"x24" throat opening. 10 or 15 HP motor. Capacity up to 700 lbs. an hour.

There's a B & J machine to meet every need. Tell us your requirements and send samples of your material for grinding in our testing laboratory. Write for brochure describing our many different size machines.

Leaders in Granulating Machinery for a Half Century

BALL & JEWELL, INC.

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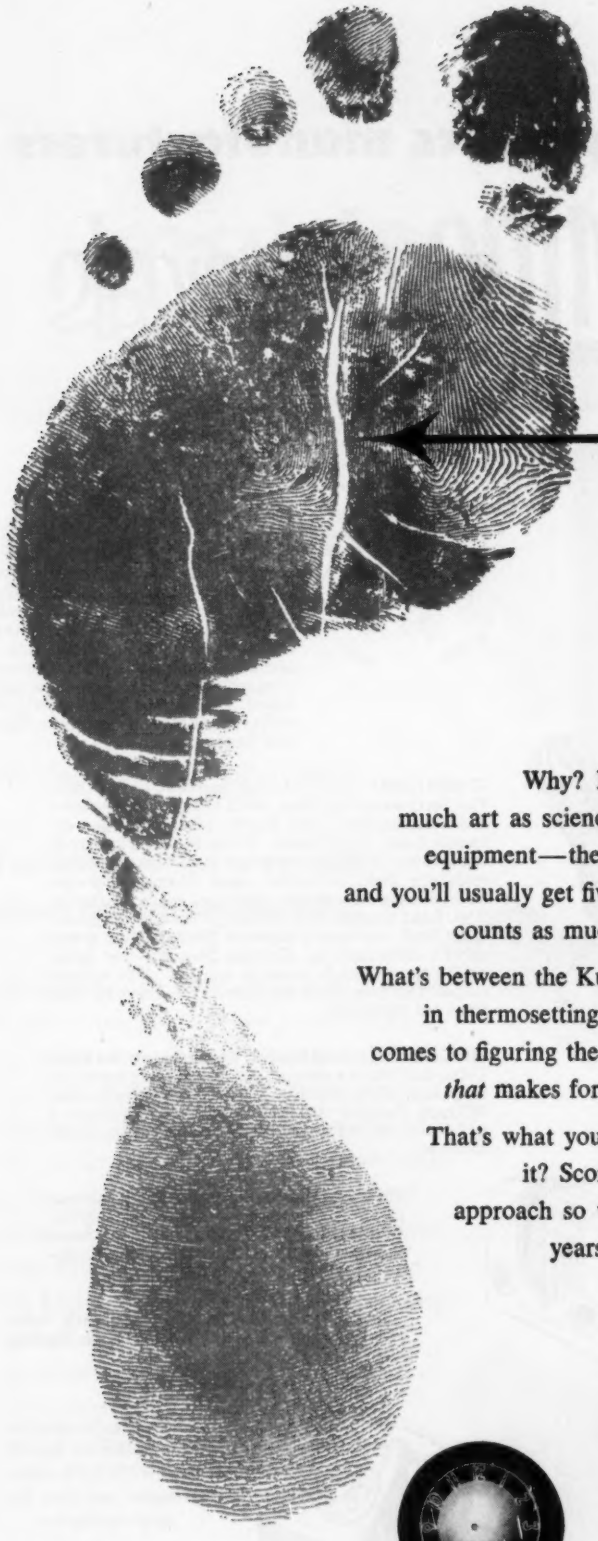


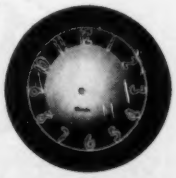
In Plastics

This is what a Moulding Job is Absolutely As Individual As

Why? It's an unusual business, moulding plastics—still as much art as science. Give five custom moulders the same presses and equipment—the same material sources—the same set of drawings—and you'll usually get five sets of results. What's between your moulder's ears counts as much—but varies as much—as what's at his fingertips.

What's between the Kurz-Kasch corporate ears is 37 years of specialization in thermosetting moulding. That makes for some orneriness when it comes to figuring the best and least expensive way to tackle your job. But *that* makes for most pleasing results in quality, price and deliveries.

That's what you're paying your money for, isn't it? Are you getting it? Scores of firms, large and small, like our individualistic approach so well that we've handled their moulding for over ten years! Why not you?



Urea clock case, 1-piece compression-moulded, for Westclox —a 10-year-plus KK customer.

KURZ-KASCH

Specialists in Thermo-Setting Plastics for 37 years

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EXPORT OFFICE: 89 Broad St., New York City, Bowling Green 9-7751.

why more and more plastics manufacturers

choose WITCO chemicals

There are many good reasons for the ever-increasing use of WITCO chemicals by the plastics industry. Here are a few of the most important:

Dependable quality
WITCO chemicals for the plastics industry are manufactured under strict quality control, carefully tested for purity and uniformity.

Complete technical service
WITCO's research and technical service laboratories make use of the most modern and complete testing equipment to answer customer problems...serving customer needs.

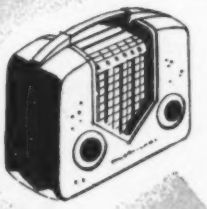
Prompt, efficient sales service
from eight WITCO sales offices throughout the country.

Investigate the advantages offered your product by the WITCO Chemicals listed . . .

PLASTICIZERS *Butyl Oleate*—secondary plasticizer imparting low temperature properties, especially to Neoprene WRT. *Butyl Stearate*—plasticizer-solvent in coating compositions. *Dibutyl Phthalate*—compatible and efficient plasticizer—especially in nitro-cellulose lacquers. *Dioctyl Phthalate*—low volatility, lack of odor, excellent light and heat stability.

STABILIZERS *WITCO Stabilizer #90*—non-toxic. For food-wrapping film. *WITCO Stabilizer #80*—cadmium-barium type liquid, efficient under dynamic heat conditions. Valuable in plastisols, organosols. *WITCO Stabilizer #70*—unusual heat stability, good lubricity. *Lead Stearate #30*—for non-transparent vinyls—electrical grade for insulation. *Lead Stearate #50 (dibasic)*—for opaque goods. High lead content. *Cadmium Stearate*—for transparent formulations. *Barium Stearate*—for color-stable items which come in contact with sulphur fumes. *Calcium Stearate*—non-toxic. Used in vinyl films for foodstuffs.

WITCARB® (precipitated calcium carbonate) Ultra-fine white extender and reinforcing agent for vinyl and other plastics. Available in three grades: Witcarb Regular (0.10—0.35 microns), Witcarb P (0.045—0.055 microns), Witcarb R (0.033—0.040 microns).



STEARATES *Aluminum, Barium, Calcium, Lead, Magnesium*—for internal lubrication and easier processing. *Aluminum, Sodium, Calcium, Magnesium, Lithium*—as gelling agents for plastigels.

CARBON BLACKS For jet-black color. Low specific gravity makes high loadings possible.

Write today for complete information on any of these WITCO Products. Samples available for your evaluation.

WITCO CHEMICAL COMPANY
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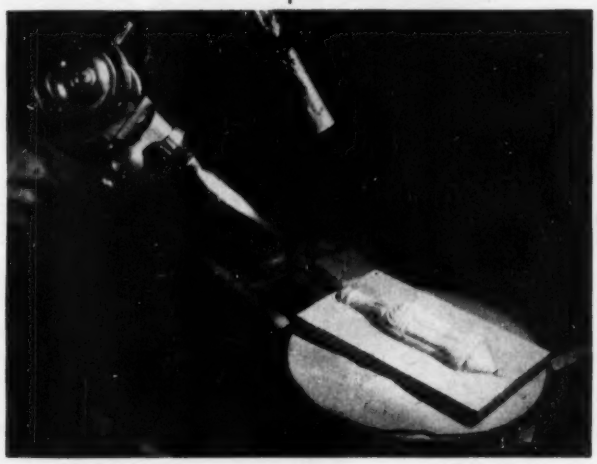
Los Angeles • Boston • Chicago • Houston • Cleveland • San Francisco
Akron • London and Manchester, England

molds made in minutes

by fast, low-cost metallizing process

For low-pressure, vacuum, slush and lay-up molding.

Metallizing, the spraying of molten metal, is now being used for the production of molds for low-pressure, vacuum, slush and lay-up processes, in a wide range of mold sizes—some lay-up types as much as 30 feet long. These metal molds are made quickly, at low cost; masters may be of metal, cloth, wood, plastic, glass, or even wax. Finest detail is retained and mold life is practically indefinite. Part spoilage, "break-out" and patching or other maintenance on lay-up molds are eliminated; improved heat transfer, better curing, assure void-free parts.



Metallizing gun building up metal mold directly on plaster master

Finished mold. Note fine detail. Spraying time 28 minutes.

MODERN PLASTICS article describes method

The article, "SPRAYED METAL MOLDS," by *Dr. Walter Brenner* and *Leopold Hase*, of Brooklyn Polytechnic Institute, which appeared in the September MODERN PLASTICS, described the process in detail. We will be happy to send you a reprint of this article on request. Use the handy coupon.

METALLIZING ENGINEERING CO., INC.
38-14 30th Street LONG ISLAND CITY 1, N. Y.
In Great Britain: METALLIZING EQUIPMENT COMPANY LTD Chobham near Woking, England

Don K. Watson
METALLIZING ENGINEERING CO., INC.
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☐ Please send me free reprint of MODERN PLASTICS article: "SPRAYED METAL MOLDS."

☐ Please have Metco Field Engineer call.

NAME_____

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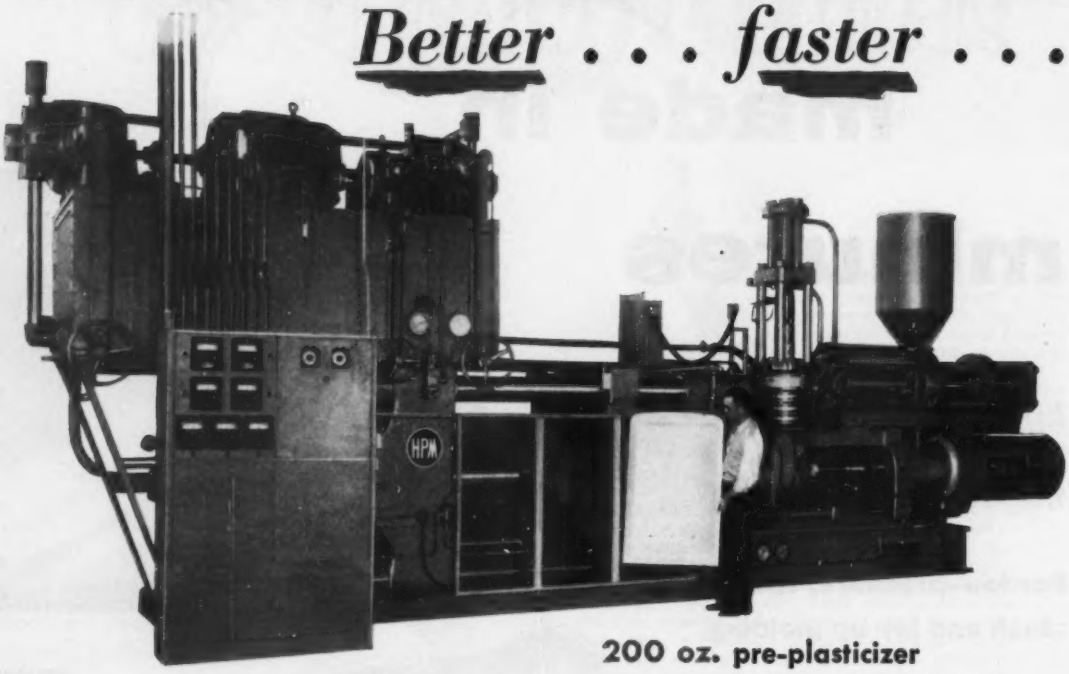
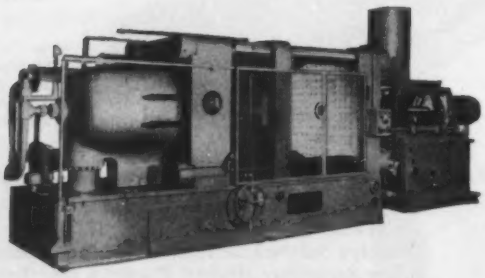
There's an HPM

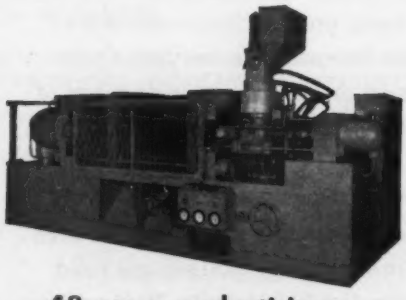
Better . . . faster . . .



200 oz. pre-plasticizer



60 oz. standard machine



48 oz. pre-plasticizer

STOCK SIZES

For Every Plastics Molding Job!

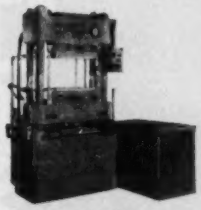
	STANDARD INJECTION MACHINES					PRE-PLASTICIZING INJECTION MACHINES				
Injection Capacity (Ozs.)	9	16	32	60	20	48	200	300	400
Plasticizing (Lbs./Hr.)	100	150	200	300	180	180	400	600	1200
Clamp (Tons)	250	350	600	1200	250	400	1200	1500	2500
Mold Space	14½"x29"	19"x33½"	25½"x43"	48"x60"	14½"x29"	25½"x36"	48"x60"	48"x66"	84"x72"
*Daylight	27"	32"	48"	60"	27"	54"	60"	108"	108"
Clamp Travel	18"	20"	24"	36"	18"	30"	36"	60"	60"

*Opening between Die Mounting Surfaces, Open Position

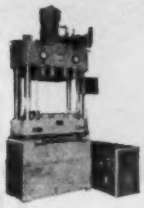
to mold it !

and at lower cost!

Reinforced Plastics Presses
A complete line of stock presses from 50 to 200 tons designed specifically for molding reinforced plastics.

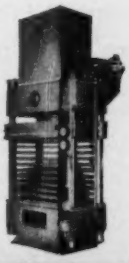


Compression Presses
Stock sizes: 100, 200, 300 and 500 tons. Larger sizes, up to 2300 tons, built on special order.



Transfer Presses
Stock sizes: 100, 200, 300 and 500 tons. Larger sizes, up to 2300 tons, built on special order.

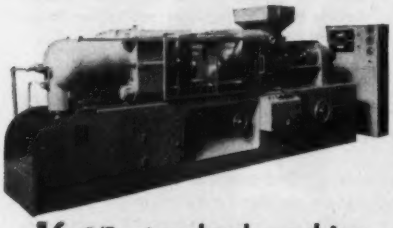
Laminating Presses
For compressing or curing laminated materials, H-P-M hot plate presses give maximum production output. Built to customers' requirements.



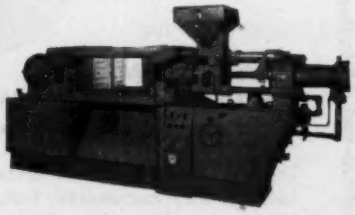
H-P-M offers molders a complete line of plastics injection molding machines, both standard and pre-plasticizing. From small to large thermoplastic parts, weighing up to 400 ounces, there's a stock H-P-M ideally suited for the job.

These advantages put H-P-M out in front in the injection molding field — direct electric heat for faster plasticization . . . positive mold sealing with all-hydraulic straight-line mold clamp. No toggles, links or cams to adjust. Exceptionally fast cycle. Quick, easy die set-up. All H-P-M pumps, valves and controls are readily accessible for easy maintenance.

Working hand-in-hand with molders in the plastics industry, H-P-M fosters a continuing program of exploration and research into plastics production processes. Result: a complete line of All-Hydraulic injection, compression, transfer, laminating and reinforced plastic presses . . . machines designed to give molders faster cycles . . . larger capacities . . . fewer rejects . . . and big savings in production costs. Write for details.



16 oz. standard machine



9 oz. standard machine

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1010 Marion Road, Mount Gilead, Ohio, U. S. A.

PRESSES FOR EVERY PRESSURE PROCESSING NEED!

HPM

"Formvac" Standard Model AA, twin-table design. Molding area 24 x 36" per platen, with up to 14" depth of draw. Models having other dimensions are under development.

FORMVAC

FORMVAC

Patents Pending

"Formvac" is a registered trade-mark of Hydro-Chemie Ltd.

NEW AUTOMATIC VACUUM DEEP DRAWING AND FORMING MACHINE molds both rigid and flexible sheet thermoplastics

The new "Formvac" revolutionizes the economics and product quality of vacuum forming. Fully mechanized, foolproof operation slashes costs of large or small articles deep-drawn from either rigid or flexible thermoplastic sheet. Swiss precision engineering and robust construction assure perfect product quality and no maintenance problems.

- **Automatic, foolproof operation**
- **Extremely fast cycles**
- **Attractively priced**
- **Early delivery**

For descriptive folder please write manufacturers:

Plastics Development Division

HYDRO-CHEMIE LIMITED
"Claridenhof", Dreikönigstrasse 21
ZURICH — SWITZERLAND

The Fox in the Well

A Fox having fallen into a well managed to keep his head above the water by sticking his claws into the sides. Soon after a Wolf came and peeped over the brink. The Fox called to him very earnestly to find a rope or something of that kind, which would favor his escape. The Wolf, moved with compassion at his misfortune, could not forbear expressing his concern: "Ah! poor Fox," said he, "I am sorry for you with all my heart. How could you possibly come into this melancholy condition?" "Nay, prithee, friend," replied the Fox, "if you wish me well, do not stand pitying me but lend me some assistance as fast as you can, for pity is but cold comfort when one is up to his chin in water and within a hair's breadth of starving or drowning."—Aesop

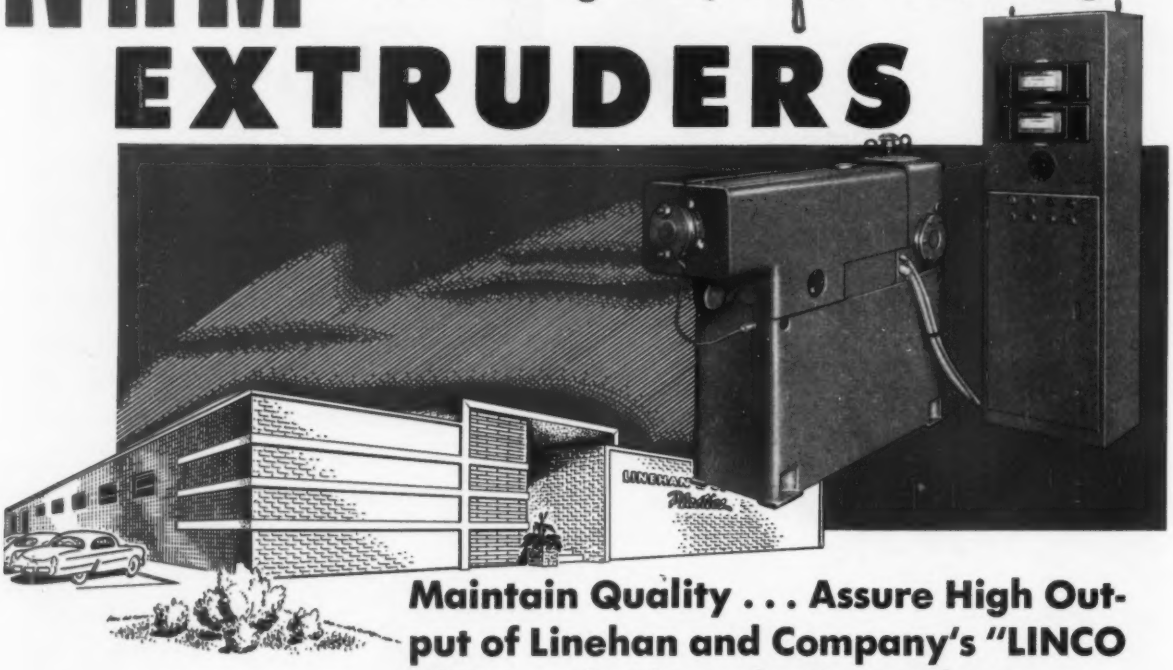
At Plenco we not only understand your problem—our wide range of quality controlled phenolics embraces a combination of properties suitable to almost any application.

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

NRM thermoplastic EXTRUDERS



Maintain Quality . . . Assure High Output of Linehan and Company's "LINCO PIPE" and other plastic products

Linehan and Company, Dallas, Texas, makers of "LINCO PIPE" and other products, is an outstanding example of the many progressive plastic producers who are profiting with NRM Extruders. A third NRM Extruder ordered for their *new* plant shown here, will give Linehan an annual capacity of over a million pounds of extruded plastics. In discussing his NRM Equipment, M. J. Linehan, President, said:

"When we decided to purchase our first extruder, we checked all sources carefully, and decided on NRM. We've never regretted that decision. Our continuing purchase of NRM Extruders speaks well for their production of quality extrusions, with a minimum of maintenance time and expense."

Whether you produce plastic film, tube, pipe, profiles or other sections, there's a standard NRM Extruder to handle your product efficiently and economically.

All Standard NRM Extruders incorporate features of advanced engineering which have been developed over a period of many years, to make NRM Equipment completely versatile when used with various accessory equipment.

Among these features are, for example, balanced heat control, the quick-opening die gate and "Cyliner" construction . . . all NRM "firsts." Together they clearly show the *greater* capacity of NRM Extruders for high output of top quality extrusions, with low maintenance expectancy. And plastics producers are quick to notice, too, the *practicability* of NRM Extruders . . . quick, easy conversion to handle any thermoplastic compound . . . space-saving compactness . . . operating simplicity . . .

CHECK the NRM line TODAY if *you* are planning to purchase plastic extruding equipment. Your inquiry brings complete details promptly, without obligation. See for yourself why so many leading plastics producers are finding it profitable to own NRM Extruders.

2227

NATIONAL RUBBER MACHINERY COMPANY

NRM

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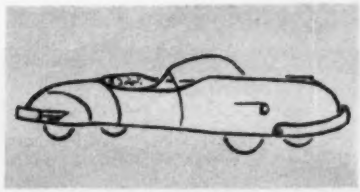
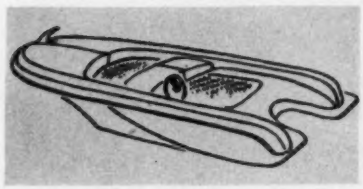
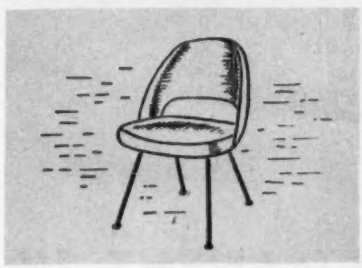
In Fiberglas® Reinforced Plastics Fabrication...

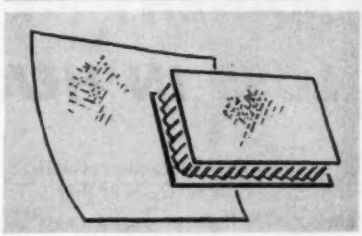
there is no substitute for experience.

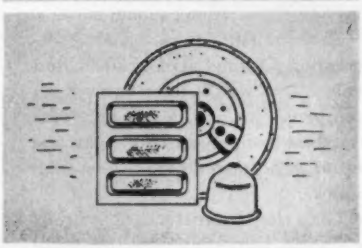
You can be sure of *Winner!*











Winner **is the pioneer in the development and production of Fiberglas reinforced plastic parts.**

Winner **has one of the largest staffs of experienced engineers in the industry. We maintain one of the best equipped laboratories in the country and devote 80,000 square feet of floor space to Fiberglas reinforced plastic fabrication.**

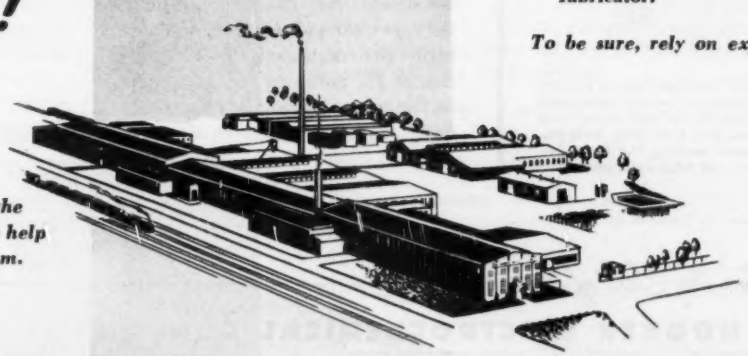
Winner **has molded a larger variety of parts — from a 3″ wave guide window to a 35′ boat hull.**

Winner **is one of the country's largest users of Fiberglas and resin molding materials.**

Winner **has pressure-bag molded more large parts and, in addition, has the best equipment for mass production of press-molded items.**

Winner **has a record of accomplishment in reinforced plastics unsurpassed by any other fabricator.**

To be sure, rely on experience!



Winner's technical staff has the know-how and experience to help solve your fabrication problem. Why not consult them?

Winner *MANUFACTURING COMPANY, Inc., P.O. BOX 399, TRENTON 3, NEW JERSEY*

Presenting

NOW . . . get PERMANENT FIRE RESISTANCE WITH NO LOSS IN HEAT RESISTANCE

TYPICAL PROPERTIES

- **Weight loss of castings:**
  After 168 hrs. at 392°F 2-3%
  After 720 hrs. at 392°F ... 13-15%
- **Flexural strength retention of glass cloth laminates:**
  After 168 hrs. at 392°F .. up to 90%
  After 720 hrs. water immersion 92%
- **Shrinkage during curing.....5%**
- **ASTM heat distortion point of castings ..... 212-220°F**
- **Electrical properties of castings at 10^9 cycles:**
  Dielectric constant 2.85
  Power factor ..... .00575
  Loss factor ..... .0164

FOR COMPLETE INFORMATION on HETRON resins, send today for technical data sheets listing properties of the liquid resins, cured unfilled resins, and glass cloth laminates. Includes general handling and curing recommendations, and other useful information.

In HETRON, a new family of self-extinguishing resins, you will find *in full measure* all the properties a good fire-resistant polyester should have.

Heat resistance, in particular, is outstanding. Castings aged at 200°C lost only 2% of weight in seven days (as compared with 10% or more for standard non-fire-resistant resins, and up to 20% for ordinary fire-resistant resins).

Glass cloth laminates aged at 200°C for seven days retained up to 90% of their room temperature flexural strength. Fire resistance was virtually unchanged in the same period.

HETRON resins are self-extinguishing even without the use of additives, because they contain 30% chemically-bound chlorine. At the same time, they are clear and stable. Where even higher fire resistance is desired, addition of 5% antimony trioxide results in laminates that will not support a flame for one second, even after five repeated applications of a Bunsen flame.

Transmission of water vapor through HETRON resins is very low, compared to standard resins—so low that it is difficult to measure accurately. Absorption of water is also lower. For these reasons, electrical properties of the resins are much less affected by long exposure to high humidities and elevated temperatures than ordinary polyesters.

Shrinkage-on-cure of less than 5% by volume, and little or no air inhibition, are important advantages of the new resins. Resistance to acids is better than that of standard resins. Heat distortion temperatures are better than with many standard polyesters.

HETRON resins are light-colored, transparent viscous liquids. At present, they are available in drum quantities.

The facilities of our laboratories are available to cooperate with you in the application of HETRON polyester resins.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

1847TH STREET, NIAGARA FALLS, NEW YORK

NIAGARA FALLS • TACOMA • MONTAGUE, MICH. • NEW YORK • CHICAGO • LOS ANGELES

HOOKER CHEMICALS

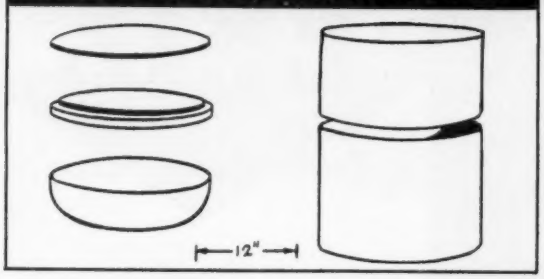
NOW! FASTER BETTER CHEAPER GLASS FIBER MOLDINGS

with Chemold Company's

MATCHED-METAL MOLD PROCESS

GLASS FIBER REINFORCED POLYESTER RESIN PRODUCTS

TYPICAL MOLDS NOW AVAILABLE

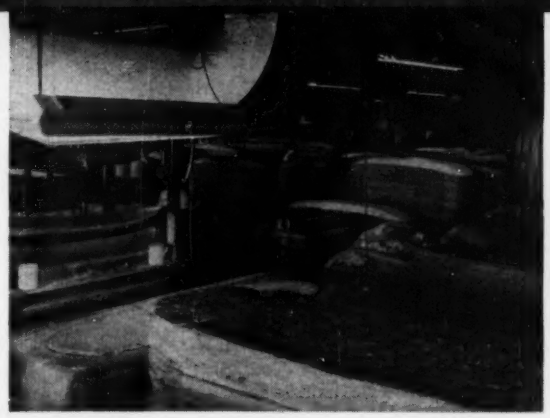


The Chemold Company is presently equipped to mold glass fiber polyester parts like those shown above and below. In addition to flat or ribbed sheets 32" x 96", other compound curvature shapes may be produced 3' wide by 8' long, or 6' wide by 6' long using Chemold's 200-ton steam-heated hydraulic presses.

CHEMOLD

CHEMOLD

"LARGEST MATCHED METAL MOLD PRESSES IN THE WEST"



Arctic Sleds Molded in One Operation

Above is one of a battery of giant matched metal mold presses capable of stamping out one reinforced glass-fiber Arctic Sled every 4 minutes for Armed Forces use.

Got a Problem Product?
Chemold's Matched Metal Molds May Produce it FASTER, BETTER, CHEAPER

AT CHEMOLD COMPANY you may discover the answer to your manufacturing problems. For CHEMOLD offers you top-flight technical know-how, backed by largest matched metal mold press installation in the West. Perhaps one of our existing molds can be converted to your own use. If not, a special mold made at low cost for your own exclusive use may provide the solution you seek. May we be of service?

CHEMOLD COMPANY, DEPT. MP-1
2000 Colorado Avenue, Santa Monica, Calif.

We are interested in ☐ development ☐ production of ....., to be molded by your process. Send details.

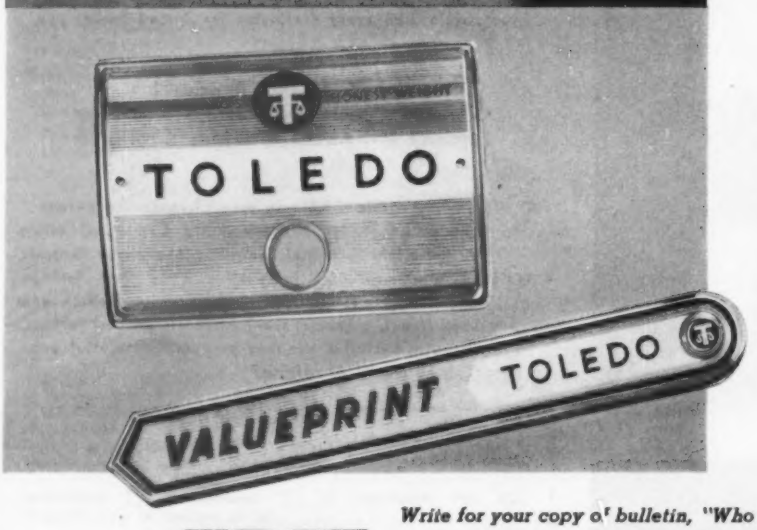
NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE ____ STATE _____

AN *Honest Weigh* TO ATTRACT CUSTOMERS . . .



with three dimensional *plastics* by

ERIE

Custom Molded Plastics

Toledo Scale Company frames the "customer's window" on their new Guardian "70" Duplex Scale and also identifies their new Valueprint Prepackaging Scale with a beautiful three dimensional plastic plate in crystal, white, silver, and red — an eye-compelling magnet that enhances the beauty of these modern food store machines.

ERIE is helping hundreds of manufacturers to add sales appeal to their products with functional parts that combine gleaming beauty with utility; and with sparkling three dimensional trademarks and name plates that make the company's identification an outstanding symbol of quality that stimulates the owner's pride of possession.

ERIE has complete facilities for the execution of your order, from mold design to precision molding, foiling, spraying, drilling and packaging.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

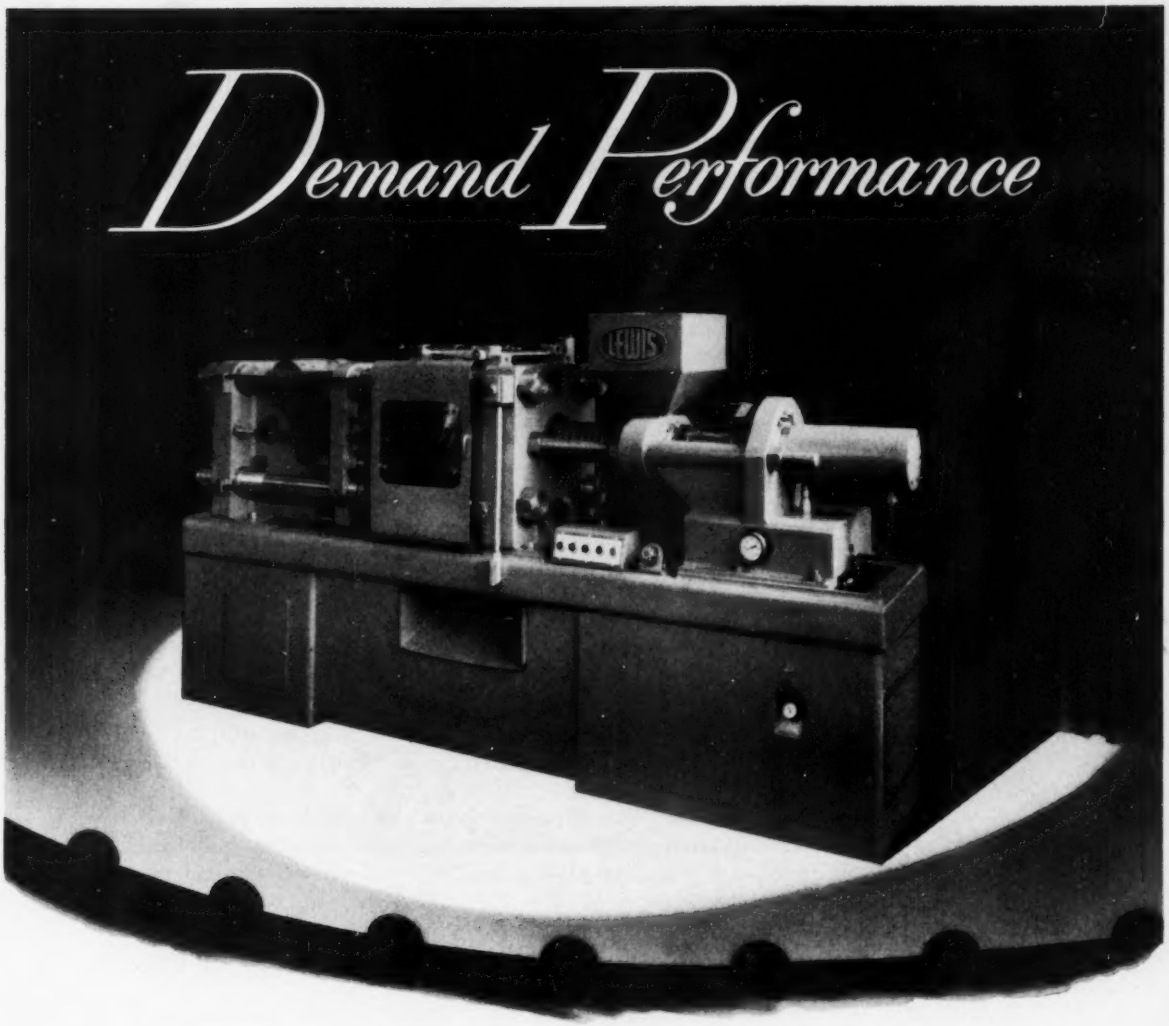
TRADE ERIE MARK

Main Offices: **ERIE, PA.**

Sales Offices: Cliffside, N. J. • Philadelphia, Pa. • Buffalo, N. Y. • Chicago, Ill. Detroit, Mich. • Cincinnati, Ohio • Los Angeles, Calif.

Factories: **ERIE, PA. • LONDON, ENGLAND • TORONTO, CANADA**

Demand Performance



Featuring the Lewis "6" Injection Molding Machine

The LEWIS Model "6" has been designed to meet injection molders' specific demands for greater economy . . . versatility . . . speed . . . and safety. This new machine can do the work of much larger units at a fraction of their initial and normal operating costs. Engineered to produce a wide variety of large projected area parts, Model "6" will plasticize up to 60 pounds of material per hour . . . mold 7-ounce shots of polystyrene at the rate of 2½ per minute.

An exclusive feature of the LEWIS "6" is the new HYDRA-LOCK clamp . . . the safest, most powerful mold clamping mechanism available today. HYDRA-LOCK utilizes only a cupful of oil to develop a 200-ton clamping pressure in tenths of a second. In addition, its design facilitates quicker, easier mold setting procedures.

For that all-important competitive advantage of high-speed low-cost production . . . specify the LEWIS "6" injection molding machine. It's engineered for demand performance.

1570-LW

Write for Bulletin 102 for complete details.

LEWIS

The Lewis Welding and Engineering Corporation

11 INTERSTATE STREET • BEDFORD, OHIO

BALL AND JEWELL, INC., BROOKLYN, N. Y. • CALCO MACHINERY CO., PHILADELPHIA • KORDENBROCK MACHINERY CO., DETROIT • NEFF, KOHLBUSCH & BISSELL, CHICAGO
N. J. OUELLETTE, LEOMINSTER, MASS. • VINMONT AND CO., NEW YORK CITY • MOORE MACHINERY CO., LOS ANGELES, SAN JOSE, SAN FRANCISCO

HIGH QUALITY at LOW COST

for reinforced polyesters

If you're seeking ways to get better polyesters at low cost, let us recommend the right DIAMOND Precipitated Calcium Carbonate for your product.

You'll get smoother surfaces, no cracks, no evidence of glass fibers when DIAMOND Carbonates are mixed with catalyzed, glass-reinforced polyesters. And your product gets improved wet strength and reduced shrinkage.

All these at lower volume cost.

DIAMOND offers these precipitated calcium carbonates for reinforced polyesters:

Surfex® MM—coated with 1% resin; particle size about 5 microns.

Kalite®—coated with 1% stearic acid; size about one micron.

Suspenso®—same as Surfex MM, but uncoated.

Multifex® MM—uncoated; particle size about .06 micron.

Write for DIAMOND technical bulletin: *No. 8 the Application, of Precipitated Calcium Carbonates with Polyester Resins.*

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

DISTRIBUTORS OF THESE PRODUCTS: C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U. S. A.; Harrisons & Crosfield (Canada) Ltd.

DIAMOND ALKALI CHEMICALS®

DIAMOND CHEMICALS

FOR THE RUBBER AND PLASTICS INDUSTRIES

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

Lighter

Stronger

Less Expensive

Thanks to Custom Molded Parts by Ideal

The business end of the famous *Electrikbroom* had to be able to absorb a lot of abuse every time a busy housewife used this light-weight vacuum cleaner. And when The Regina Corporation decided that plastics offered many advantages over the previous nozzle unit which consisted of many parts requiring complicated assembly procedures, Ideal Plastics seemed the logical supplier to fill their requirements.

Ideal's engineers pitched in on the new design, suggesting a number of modifications which made molding less expensive, cut the cost of assembling, and in no way reduced the efficiency of the new parts. When the molds were made, the two pieces were injection molded of a smash-defying high impact styrene which Ideal recommended. The rich maroon color is molded-in, so it can never wear off.

If you want to be as completely pleased with your plastics parts as The Regina Corporation is with theirs, call on Ideal. In countless instances we have injection molded major and minor components and entire plastics products for America's foremost companies. Our engineering assistance and cooperative service can be invaluable.

For details on what we can do for you, contact A. C. Mansvill, Vice President in Charge of Sales, Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000. Midwest Representative, Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136.

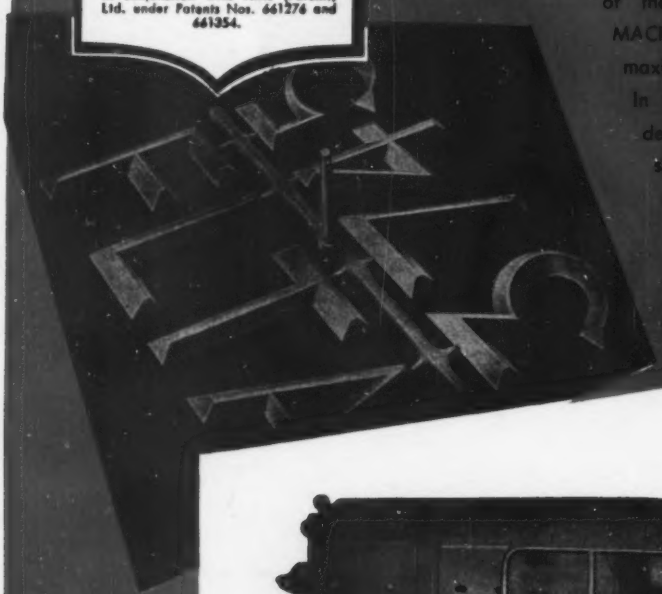
Better Molded Plastics Ideal *for Industry & Home*

facts

that speak for themselves

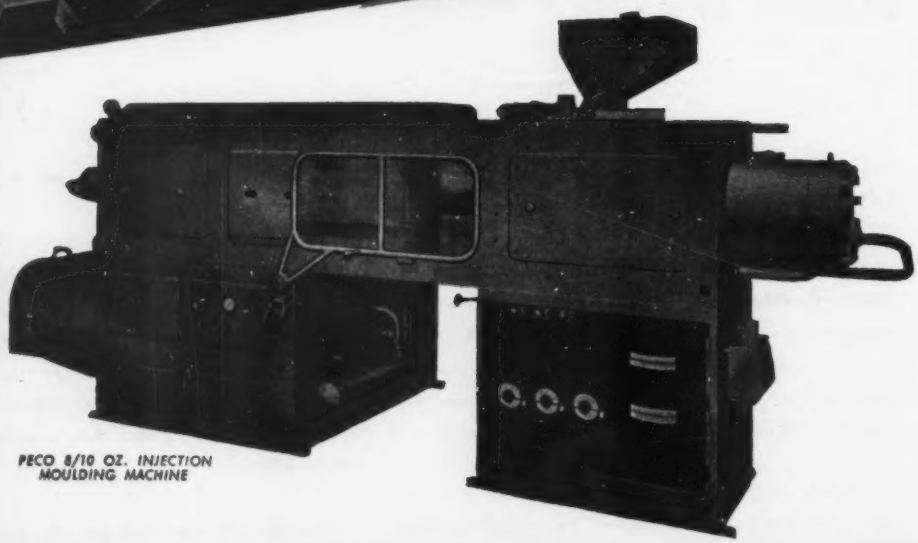
12,000
SHOTS *per* WEEK

8-impression moulding in polythene, of automobile number plate digits and letters. Mould designed and mouldings produced by the Montmore Manufacturing Co. Ltd. in conjunction with Hills (Patents) Ltd. under Patents Nos. 661276 and 661354.



This record of weekly production can be taken as typical of the first-class performance of PECO MOULDING MACHINES. Their output can be relied on—and it is a maximum output for any type of production.

In the 8 oz. and 16 oz. machines, important new developments have been introduced, giving increased shot capacity and enabling these models to be uprated to, respectively, 8/10 oz. and 16/24 oz. machines. Further details of the full range, including smaller capacity machines, will be gladly sent on request.



PECO 8/10 OZ. INJECTION MOULDING MACHINE

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to complete specification, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for moulds and mould-bases—the plant includes a 2,000-ton hobbing plant. Master hobs to customers' samples made as required.

PECO PRODUCTS

THE PROJECTILE & ENGINEERING COMPANY LTD.

ACRE STREET, BATTERSEA, LONDON, S. W. 8, ENGLAND

MUEHLSTEIN
VIRGIN POLYSTYRENE
As exclusive distributors for Fostarene—Muehlstein offers you a dependable source for quality Virgin Polystyrene. Our experienced technicians and nation-wide sales organization stand ready to serve you.
MUEHLSTEIN
REPROCESSED PLASTICS
If you sell plastic scrap . . . use reprocessed plastics or have your scrap reprocessed—look to Muehlstein for reliable service. Our complete laboratory facilities and technical staff assure satisfaction, especially with color problems.
H. MUEHLSTEIN & CO. INC
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BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis
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products change . . .

trim assembly's "bite" in

When you have planned assembly savings, make sure they *pay off* on the assembly line by specifying PARKER-KALON Self-tapping Screws. The *originator* of these time-proved metal fasteners, P-K learned long ago how to provide the proper combination of hardness and toughness, the sharp threads and accurate size, the consistent dependability that keeps assembly trouble-free.

Question *every* fastening, on the drawing board, and in present assemblies. Plan now to make savings you've been missing. A P-K Assembly Engineer will call at your request. Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.

The INDUSTRIAL DISTRIBUTOR steers your Supply Dollars to the best values

Assembly's percentage of total production costs runs from less than 10% in simple "gadgets" to as much as 75% in modern aircraft. Trimming this percentage to the lowest figure possible—eliminating all needless expense—is a challenge to every manufacturer whose assemblies involve fastenings to metal or plastics.

It's a job that will be just as important in 1964 as in 1954, regardless of changes in product design. Parker-Kalon's fastening specialists will be ready then, as they are now, to help you set new records for low cost assembly.

production costs with . . .

PARKER-KALON®

IF IT'S P-K IT'S O.K.

The Original **SELF-TAPPING SCREWS**

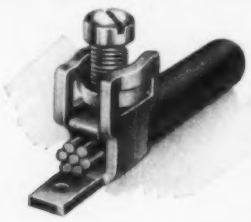
Cold-forged **SOCKET SCREWS**

AND OTHER FASTENING DEVICES

More Power to You!

HUBBELL
REG. U.S. PAT. OFF.

LEADS AGAIN IN SIMPLIFIED WIRING WITH NEW RANGE RECEPTACLES CONTAINING PATENTED PRESSURE TYPE TERMINALS



Another triumph of Hubbell knowledge and experience. The advanced 50-amp, 250 volt, 3-wire range receptacle really simplifies wiring in even most difficult locations. New one-screw pressure type terminals accommodate wires from No. 2 down to No. 8, have only one removable part. And clamp locates automatically in terminal plate channel, rotates to locked position with first quarter turn of screw. No soldering needed. For the answer to all your wiring problems, write Harvey Hubbell, Inc., Bridgeport, Connecticut.

a Strip back wire insulation 7/8 in. — lay wire in terminal plate channel.

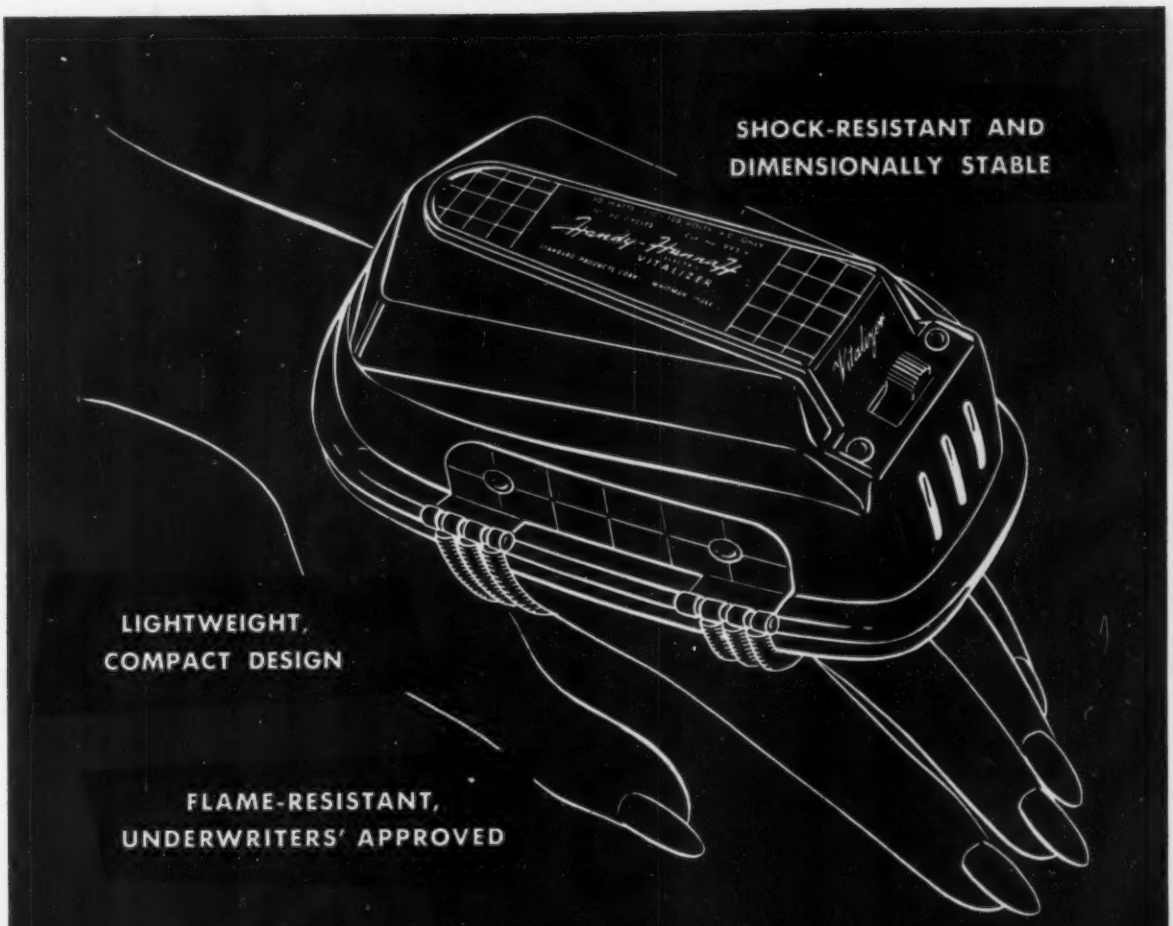
b Place pressure plate assembly in channel over wire as shown.

c Apply screwdriver. The first quarter turn will rotate and lock the wing nut in slots. Screw down tightly to secure tight electrical connections.

MORE PLASTIC MOLDING SKILLS CAN HELP SOLVE MANY PRODUCT PROBLEMS

Bridgeport makes the one-piece, precision-molded phenolic casing that helps Hubbell produce a superior product. Another example of the skills, knowledge, and facilities that are helping make advanced products in all fields. Perhaps Bridgeport can help you, too. Write today to . . .

BRIDGEPORT MOULDED PRODUCTS, INC.
Box 3276, Barnum Station • Bridgeport, Conn.



Handy-Hannah designed to sell with

HERCOCEL®

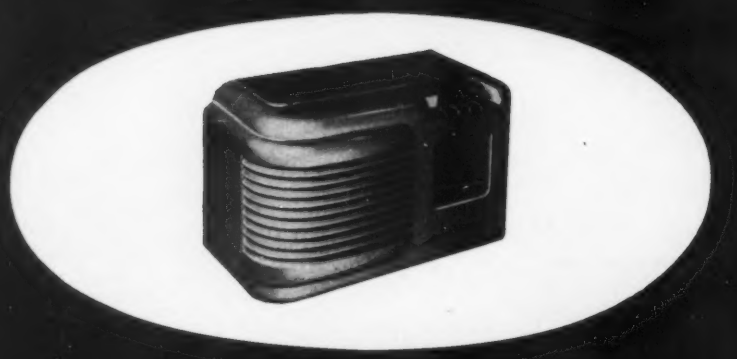
The new Handy-Hannah Vitalizer is another easy-to-mold, easy-to-sell product made with flame-resistant Hercocel A. Its modern design and attractive gray housing make the Vitalizer a standout on display. Its compactness and sturdy feel induce prospects to buy. And its light weight reduces hand fatigue in use. Whether you make household or industrial appliances, it will pay to explore the economy and salability of the Hercocels. For complete information and details on the design assistance, technical counsel and laboratory facilities that go with these thermoplastics, write:

HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market St., Wilmington 99, Del.

CP53-9

Molded for Standard Products Corp., Whitman, Mass., by Cowan & Boyden Corp., Providence, R. I.

for **TOUGH** molding jobs . . .



METASAP* STEARATES deliver easier mold release

When you have a tricky molding problem . . . when you're deep drawing or producing large pieces, Metasap Stearates in the molding compound provide outstanding lubrication for easy ejection from the mold.

Either incorporated into the molding compound or dusted onto mold surfaces Metasap Zinc or Calcium Stearates give outstanding lubrication so that lower ejection pressures are needed. Thus, you can expect increased output, fewer rejects, improved finished products and longer mold life.

So specify compounds containing Metasap Stearates or incorporate them directly into your own molding compound. Metasap Technical Service will help you with the proper material and mixing procedure for your needs.

. . . and to produce economical plastigels

As a thickening agent for plastisols, Metasap provides a complete line of quality Stearates. We'll be glad to make available to you free experimental samples of Magnesium, Barium, Calcium and Aluminum Stearates. They are ready for immediate shipment now.

METASAP CHEMICAL COMPANY, Harrison, N. J.

Branches: CHICAGO • BOSTON • CEDARTOWN, GA. • RICHMOND, CALIF.

Stocks at: Cleveland, Ohio; Louisville, Ky.; Los Angeles, Cal.; Portland, Ore.; Spokane and Seattle, Wash.

*Reg. U. S. Pat. Off.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

Now! Electronic Welding of plastics a faster AUTOMATIC operation with the New

Thermatron TURNTABLE

Latest unit in THERMATRON's expanding line of electronic heat sealing machinery for vinyl plastics is this new turntable with an indexing arrangement which makes possible *automatic operation* of *any* THERMATRON press and generator! It not only speeds up production, but is unusually simple to operate, reduces actual labor, and guarantees uniformity of product.

A number of loading trays are spaced around the outer edge of the table. When the items to be sealed are loaded in the trays the table rotates into position and the press closes and seals automatically. Entire operation is controlled by an electric timer insuring accuracy . . . And speed can be set to the fastest operator's pace. With less handling of the unit to be sealed the safety factor is increased and the operator is free to achieve a higher output.

Turntable is available in sizes up to 60" in diameter – adjustable for 4, 6, 8, 12 and 24 indexes per revolution. A maximum of 30 seals per minute is possible.

Radio Receptor engineers will gladly give you further details on the new Thermatron Turntable Model T-T-2. Write or telephone us today for your copy of bulletin no. 79

THERMATRON DIVISION

RADIO RECEPTOR COMPANY, INC.

In Radio and Electronics Since 1922

SALES DEPARTMENT: 251 WEST 19TH STREET, NEW YORK 11, N. Y.

Chicago: 2753 West North Avenue

Los Angeles: Electroseal Plastics Co., 130 North Juanita Avenue

Factories in Brooklyn, N. Y.

From Coal to Plasticizer
in 299 yards!

WHEN only a few hundred yards separate your raw materials from your finished product, you're *really* basic! That's exactly the way we produce Pittsburgh PX Plasticizers . . . in a basic and integrated operation from coke ovens, through coal chemical and phthalic anhydride plants to final shipment from our modern new plasticizer plant.

The result? Quality-controlled production every step of the way, and a broad family of thirteen plasticizers with the high standards of purity, water-whiteness and stability you want. There's a good chance our engineers will be able to help you achieve better, more efficient production at your plant. Why not call or write us about it, *today!*

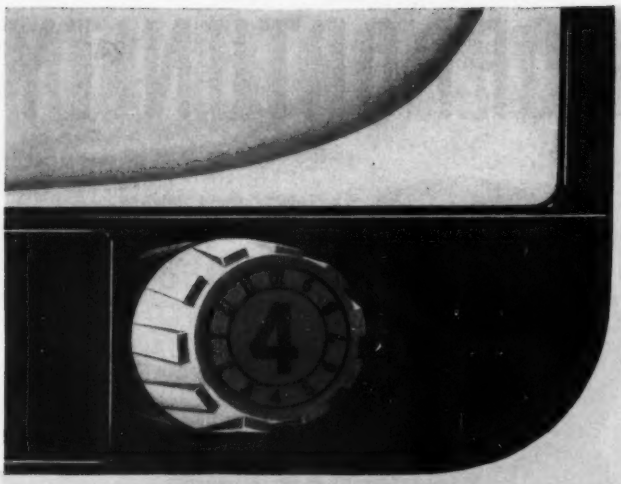
PITTSBURGH PX PLASTICIZERS

PX-104 DiButyl Phthalate
PX-108 DiIsoOctyl Phthalate
PX-109 DiNonyl Phthalate
PX-138 DiOctyl Phthalate
PX-158 DiCapryl Phthalate
PX-208 DiIsoOctyl Adipate
PX-209 DiNonyl Adipate
PX-238 DiOctyl Adipate
PX-404 DiButyl Sebacate
PX-408 DiIsoOctyl Sebacate
PX-438 DiOctyl Sebacate
PX-658 TetraHydroFurfuryl Oleate
PX-917 TriCresyl Phosphate

W&D 4646

PITTSBURGH
COKE & CHEMICAL CO.

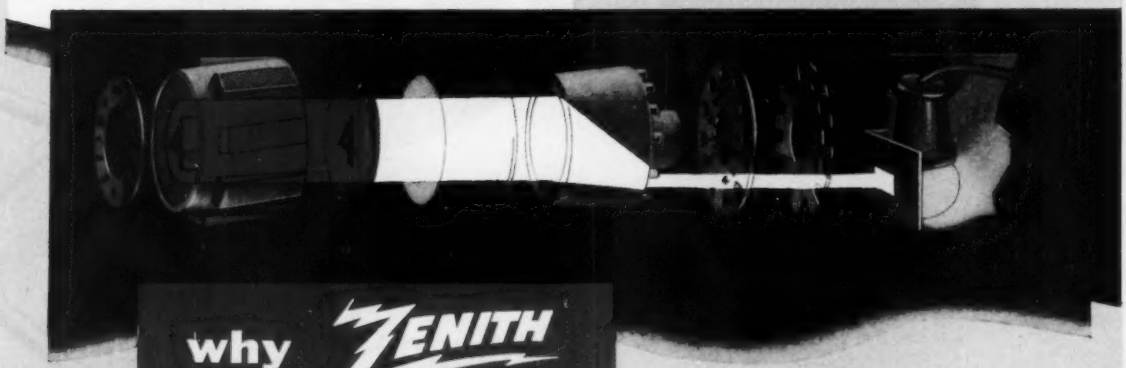
COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON



To improve legibility of channel numerals in the semi-dark conditions under which TV is normally viewed, ***Zenith*** *followed the principle of optical projection in designing this Selector Knob. When the viewer dials a channel, a pinpoint of light from the pilot passes through the corresponding number on the channel numerical disc and continues on through the inner knob shell where it is fanned into a wider band of light. As a result, the numeral image appears magnified when it registers on the projection screen and colored disc which are mounted in the front opening of the outer knob shell.*

A product as intricate as this demands special engineering skills, experience and equipment. ***Zenith*** *calls on* ***Santay*** *for metal and plastic parts . . . clear proof of how a perfectly combined operation results in a perfectly combined product.*

Clear Proof!



why ZENITH chose Santay for their TV Channel Selector Knob

Santay *serves manufacturers of all sizes. Production is scaled so that every job, no matter how large or how small, measures up to strict, company-set efficiency standards.*

Write today for new full color book, "Precision Manufacturing!" It's yours free . . . with no obligation.

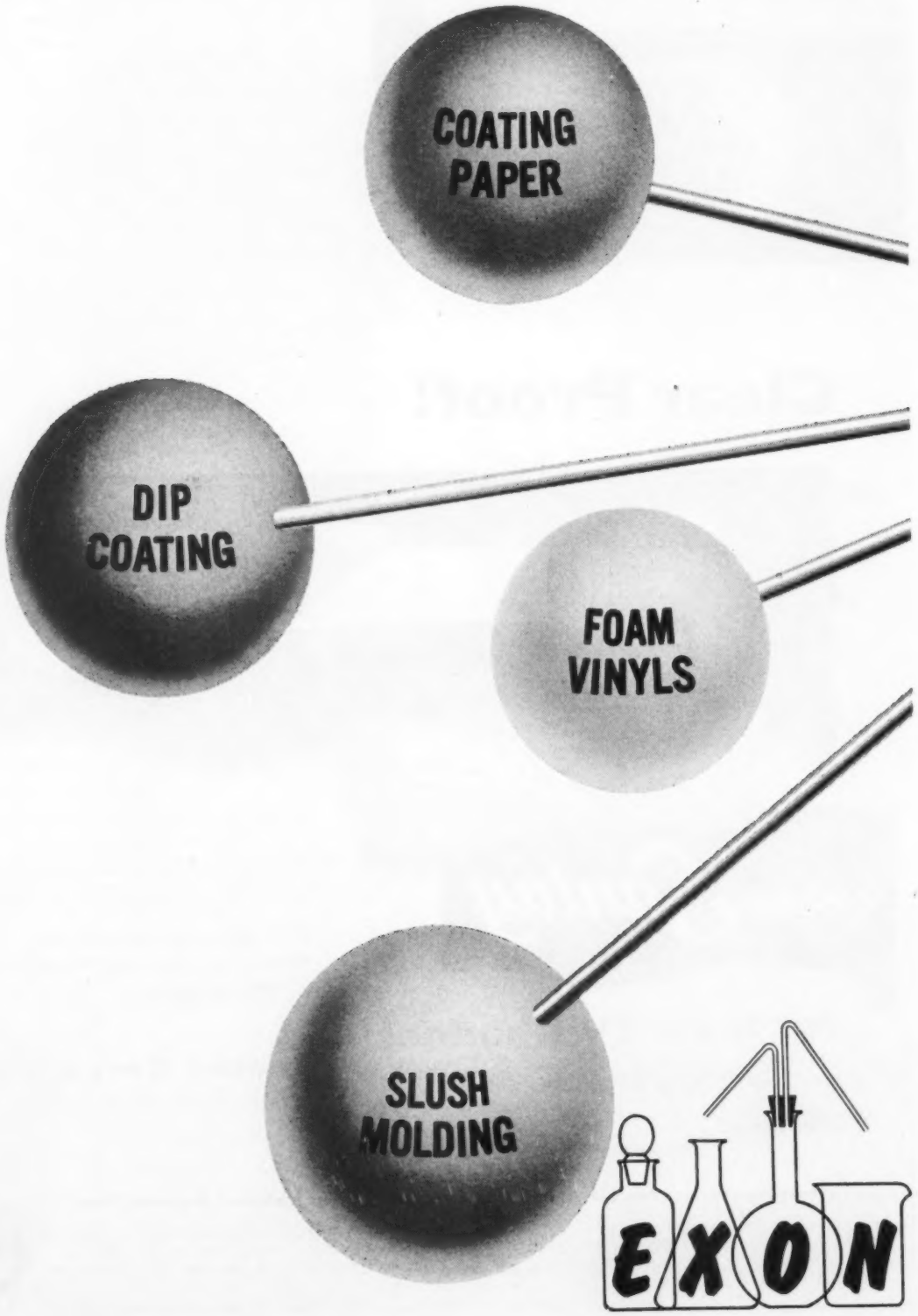
Santay Corporation

355 North Crawford, Chicago 14, Illinois

Injection Molding • Metal Stamping • Electro-Mechanical Assemblies

Representatives: George H. Timmings & Co., 1802 North Damen Avenue, Chicago 47, Illinois ★ **Queisser Bros.,** 110 East Ninth Street, Indianapolis 2, Indiana ★ **Stanley J. Roberts & E. H. Vannorwick,** 5-259 General Motors Bldg., Detroit 2, Michigan **William S. Richards Co.,** No. 2 South Brentwood Boulevard, Clayton, St. Louis 5, Missouri ★ **E. J. Edmunds,** 101 North Lexington, Havertown, Pennsylvania ★ **Jack Baran,** 801 Bird Avenue, Buffalo, New York.

A GREAT NEW OPPORTUNITY



FOR PROCESSORS...

Let us send you a sample of

the new plastisol resin that needs no grinding!

PHYSICAL PROPERTIES OF *EXON* 654

Readily dispersed in plasticizer by simple stirring—no grinding necessary.

Form	Fine White Powder
Specific Gravity	1.40
Average Relative Viscosity	2.65

For complete information on EXON 654 or any other resin in the extensive Firestone EXON line, write or phone... Chemical Sales Division, Firestone Plastics Company, Dept. 20B, Pottstown, Pa.

EXON 654 is the latest result of Firestone's unceasing research to bring you the ideal resin for your particular application.

This stir-in type plastisol resin is expressly created to impart excellent heat and light stability, paste viscosity stability, physical toughness and chemical stability to your final products.

If your application calls for casting thin films, coating paper... fabrics... dip coating, slush molding or foaming operations, why not assure yourself of a top-grade product by specifying EXON 654?

Or, if you have need of some other type of vinyl resin, contact Firestone and let another member of the ever-growing EXON line show you a short cut to a finer product.

CHEMICAL SALES DIVISION

Firestone Plastics Company, Dept. 20B, Pottstown, Pa.

Division of The Firestone Tire and Rubber Co.

Which millions are best prospects for plastics?

3¾-million families, screened for the BUY on their minds

HERE'S your *solid core* of progressive, BUY-minded families — your primary market for plastics products.

These families have been *preselected* for you by Better Homes and Gardens' editorial planning—among families of high income and home ownership.

They read BH&G to raise living standards even higher. In fact, BH&G is the only one of the three largest man-woman magazines to grow great by showing its readers how to get more out of life—and what to buy to do it with.

They already have plastics products by the millions—and are in the market for millions more. Tell your story to these millions who *want* what you have to sell — and have the money to buy! They are your "best buy" *primary* millions.

PROOF OF BH&G FAMILIES' INTEREST IN PLASTICS.

A plastic toy manufacturer writes, "Returns on the ad far exceeded our fondest expectations."

A manufacturer of a plastic wall tile received 1,671 inquiries from his half page advertisement just 21 days after his ad appeared.

Over 10,000 inquiries were received by a plastic fabric manufacturer from two advertisements run in Better Homes and Gardens.

Another plastic wall tile manufacturer received a total of 1,469 inquiries a short while after his advertisement appeared in BH&G.

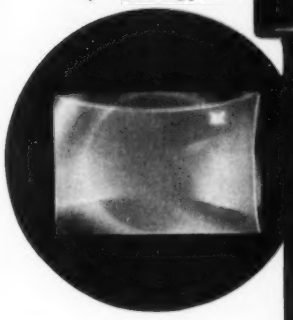
MEREDITH PUBLISHING COMPANY, Des Moines, Iowa

MICO-VUÉ, molded and assembled for Mico Photo Products, Chicago

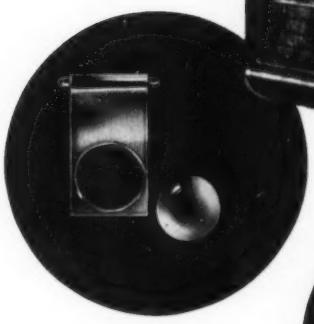
Inside side-section view, note insets

Fine optical glass lens, which, together with reflecting mirror, was included in our assembling job

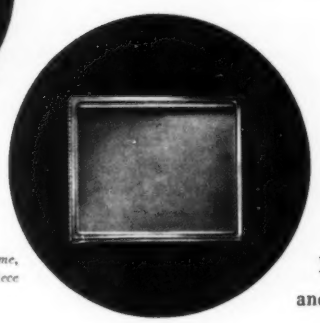
Outside side-sectional view, note design detailing



Baby picture, Santa Fe Photo



Plastic lens hinged mount for magnifying glass



Plastic diffuser and frame, molded in one piece

NEW VIEWER

New View on what Plastics Can Do

You can draw some profitable conclusions for your own plastic products from these views of Mr. "Mike" Wolk, president of Mico Photo Products. Mr. Wolk said he wanted his viewer to be plastic not only because of the lower production cost, but for the greater attractiveness and color variety which he felt plastics afforded over other materials. This, then, was a complete start-to-finish molding and assembling job for us. Everything that went into this new viewer except its fine precision optical lenses and metal slides was made of plastic.

Economy and strength were the factors in molding the Mico-Vué with a minimum number of castings. The light diffuser and frame were molded in one piece for greater economy and more attractive appearance. Even the lens hinge mounts were molded.

Although this viewer is new, the idea of doing a thorough engineering and molding job economically and beautifully is an old story with us. We'd like to tell you that story and show you how we can serve you. Just let us know when we may. We'll do the rest.

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted] piping, tubing and fittings, write for circulars containing data and illustrations.*

*Trademark Registered

ELMER E. MILLS CORPORATION

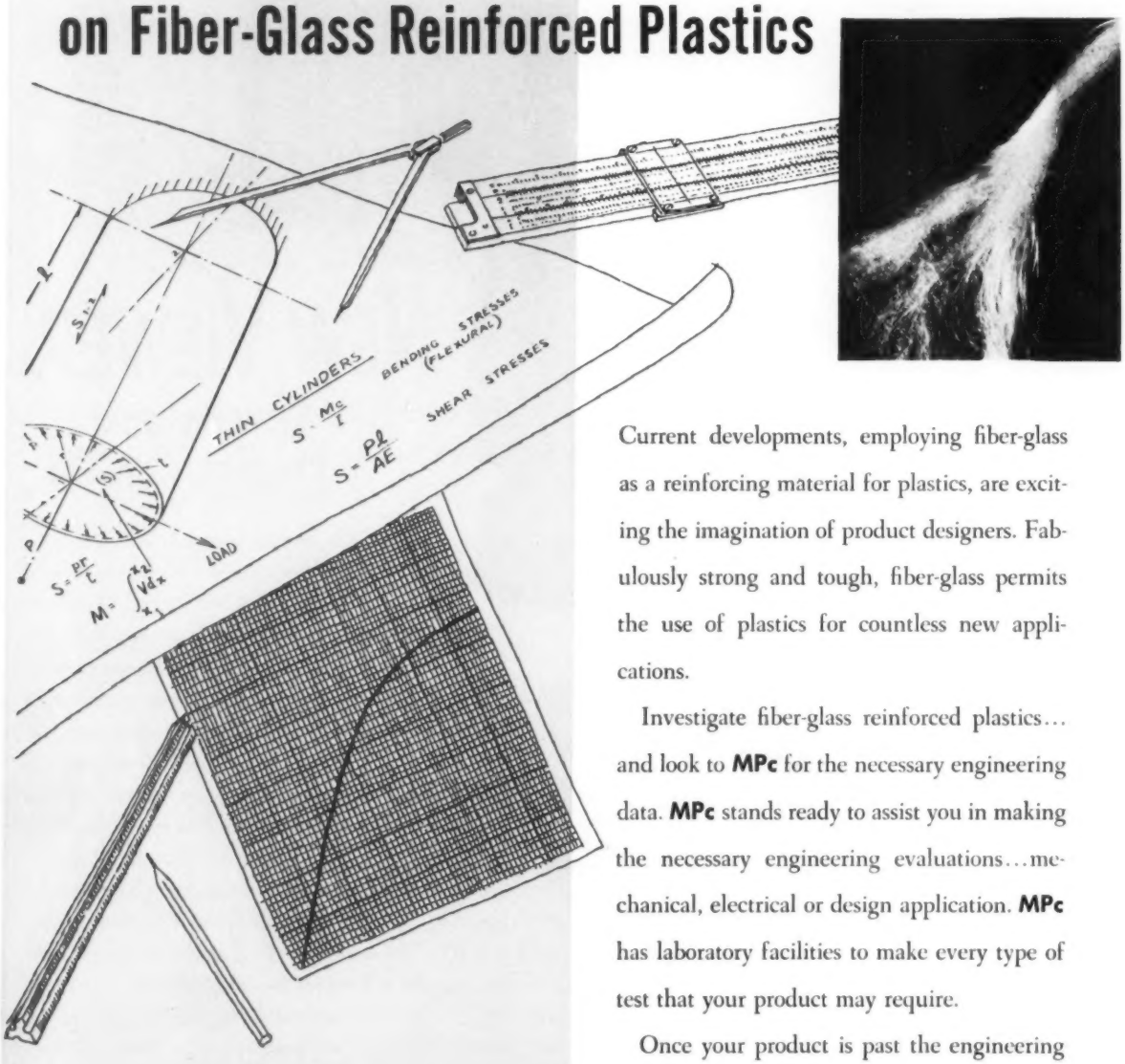
a subsidiary of **CONTINENTAL CAN COMPANY**

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Fibestos, Lucite, Nylon, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Carex, Forticel, [redacted]*, Saran, and other Thermoplastic Materials.

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Look to MPc for Engineering Assistance

on Fiber-Glass Reinforced Plastics



Current developments, employing fiber-glass as a reinforcing material for plastics, are exciting the imagination of product designers. Fabulously strong and tough, fiber-glass permits the use of plastics for countless new applications.

Investigate fiber-glass reinforced plastics... and look to **MPc** for the necessary engineering data. **MPc** stands ready to assist you in making the necessary engineering evaluations...mechanical, electrical or design application. **MPc** has laboratory facilities to make every type of test that your product may require.

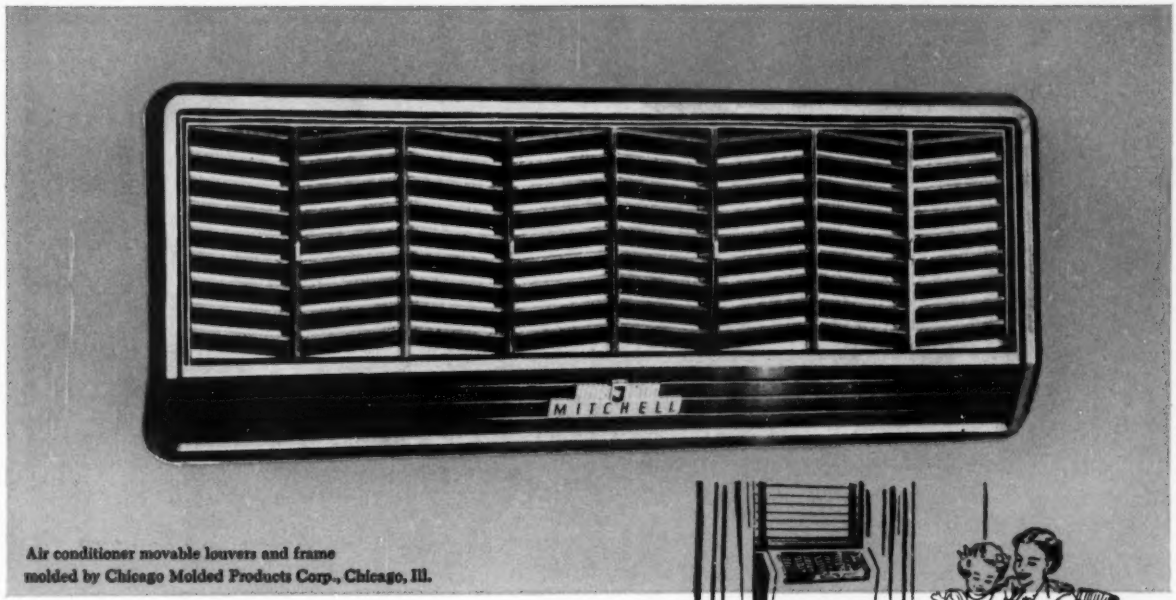
Once your product is past the engineering stage, **MPc** offers unexcelled tooling and production facilities. Address your inquiry to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Ill.

MOLDED MPc PRODUCTS

DIVISION OF
ADMIRAL DISTRIBUTORS, INC.
4535 W. Harrison St., Chicago 24, Ill.

...Pace-Makers in Plastics Molding

MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI



Air conditioner movable louvers and frame molded by Chicago Molded Products Corp., Chicago, Ill.

"FOUR SEASONS" SERVICE

From a Four-Way Grille of BAKELITE PHENOLIC PLASTICS

TRADE-MARK

The Mitchell "Four Seasons" room air conditioner can work the year round . . . it cools air in summer, warms it in winter.

Its four movable louvers and their frame are molded of BAKELITE Phenolic Plastics to match this all-round service. They can be turned to direct the air in four directions. Frequent handling for adjustments won't hurt them. Heat, cold, and moisture won't affect their shape. Their colors are molded in—there's no applied finish to chip or peel. Their fine, clean lines reflect the efficient design and performance of the unit.

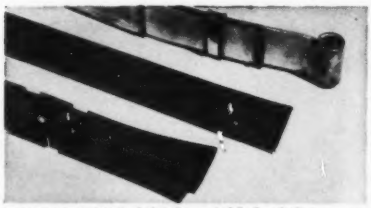
The name plate and concealed splash ring are also molded of BAKELITE Phenolic Plastic—demonstrating that this material can range from the purely decorative to the highly utilitarian. It is resistant to chemicals, oil, grease, vibration. It has excellent electrical properties when required. It comes in a variety of types to fit many different jobs.

These features of BAKELITE Phenolic Plastics may cut your production problems, bring more sales. Learn how they can be applied. Bakelite Company engineers will help. Write Dept. RU-21A.

BAKELITE
TRADE-MARK
PHENOLIC PLASTICS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.



SPRING PADS, injection molded of BAKELITE Polyethylene, separate spring leaves, keep dirt out, prevent metal contact. Give long service at low cost. Made by Spring Perch Co., Lackawanna, N. Y.

SALAD SERVICE molded of BAKELITE C-11 Plastic resists salad oil, fruit juices, washing in hot water. Production costs are low. Has good finish, impact strength. Made by Jim Robbins Co., Royal Oak, Mich.

BRISTLES on this sponge mop are BAKELITE Styrene Plastic monofilaments that retain stiffness, withstand soap and detergents, won't curl. Dirt can't penetrate. Made by Buff Products Co., Port Chester, N. Y.

How BAKELITE TRADE-MARK plastics build better products

this NEW BOOKLET gives you the facts

Look into BAKELITE's family of plastics right now for new product ideas. You'll find materials engineered for scores of uses—materials that provide properties in the right combinations for hundreds of jobs.

Send for a copy of this new 8-page booklet. It describes the broadest line of plastics and resins available from one source. Illustrations show how these materials are being used successfully in scores of new and varied jobs.

Then call in your nearest Bakelite Company representative. He can point out the best plastic for your needs—tell how it should be used—give expert guidance and technical assistance at every important step. No obligation, of course. Mail the coupon today!

MOLDING AND EXTRUSION MATERIALS
Phenolic Plastics • Vinyl Rigid Plastics • Vinyl Elastomeric Compounds • Styrene Plastics • Polyethylene Plastics

WIRE AND CABLE COVERING
Polyethylene Wire Covering • Vinyl Wire and Cable Insulation

BONDING RESINS
Phenolic bonding resins for abrasives, frictional elements, and sand shell molds for foundry castings.

PROTECTIVE COATING RESINS
Phenolic, Styrene, and Vinyl Resins for Metal and Concrete Coatings • Vinyl Resin Coatings for Paper, Foil, Cloth • Vinyl Dispersion Resins • Polyethylene Resin Coatings

LAMINATING PLASTICS
Phenolic, Polyester and Epoxy Resins for plastic laminates.

RIGID SHEETS
Vinyl Plastic Rigid Sheets • Vinyl Plastic Rigid Sheets for Signs

FLEXIBLE FILM AND SHEETING
Vinyl Film and Sheeting • Vinyl Plastic Cast Film

CALENDERING MATERIALS
Vinyl Calendering Resins

BAKELITE COMPANY, Dept. SH-69A
A Division of Union Carbide and Carbon Corporation UCC
30 East 42nd Street, New York 17, N. Y.

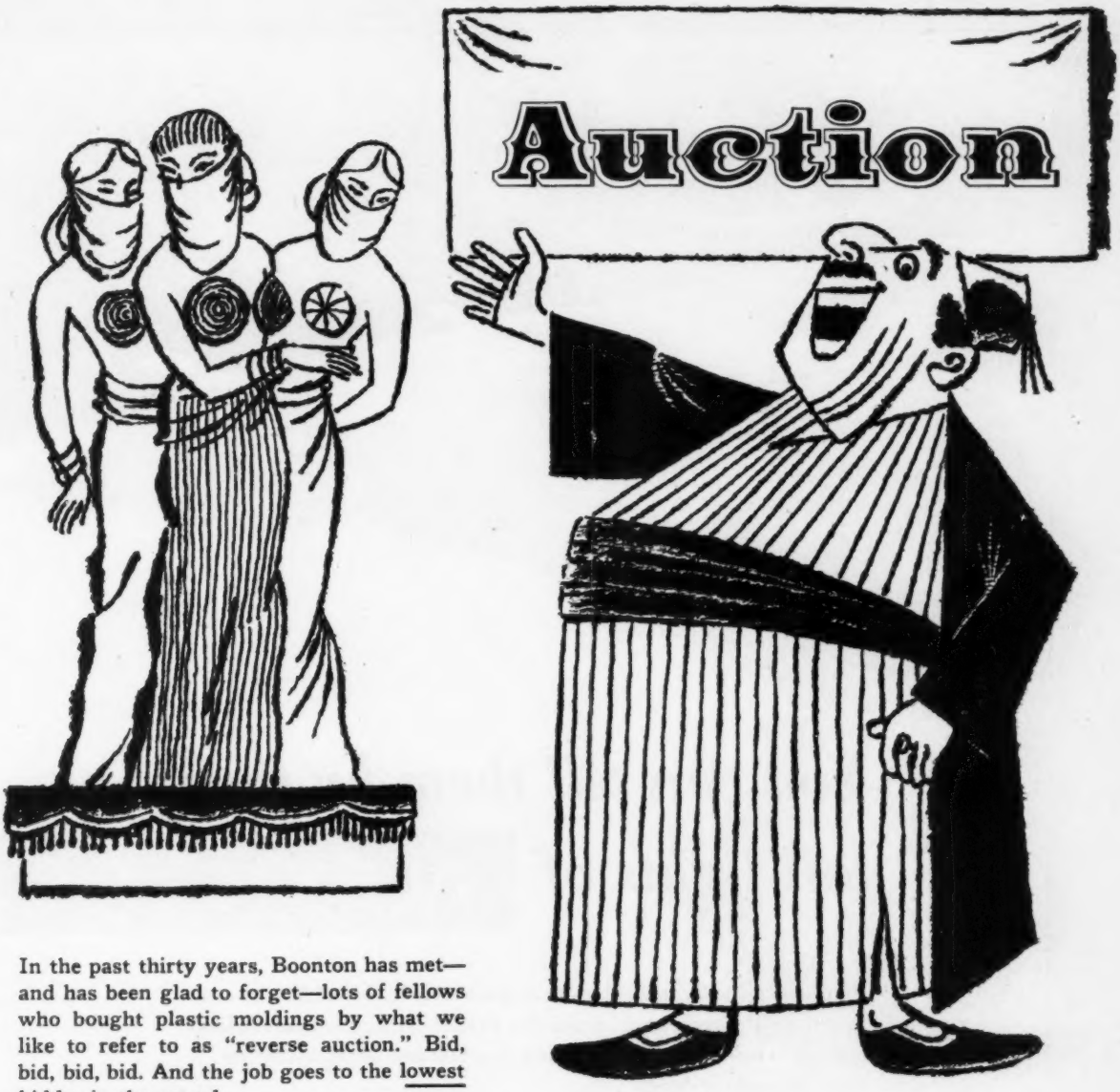
Please send me a copy of the 1954 Condensed Reference File of BAKELITE Plastics and Resins.

*Name*_____ *Title*_____

*Company*_____

*Street*_____ *City*_____ *State*_____

BAKELITE
TRADE-MARK
PLASTICS AND RESINS
TRADE MARK
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 E. 42nd Street, New York 17, N.Y.
In Canada:
Bakelite Company (Canada) Ltd.,
Belleville, Ont.



In the past thirty years, Boonton has met—and has been glad to forget—lots of fellows who bought plastic moldings by what we like to refer to as "reverse auction." Bid, bid, bid, bid. And the job goes to the lowest bidder in the crowd.

We can't remember when Boonton ever landed a custom molding job by winning a "reverse auction." Our customers never seem to want the shoddy workmanship, the uncertain deliveries, the headaches and heartaches that lowest-bid-buyers set themselves up for.

Of course, our customers are concerned about pricing. But they are just as concerned, if not more so, about getting quality moldings, and about getting them by a specified date.

If you buy by "reverse auction," Boonton would just as soon never know you bought a single ounce of molded plastics. On the other hand, if you want quality injection or compression molding at prices which permit us to give you everything you specify without slitting our own throats, we'll be pleased to meet you.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

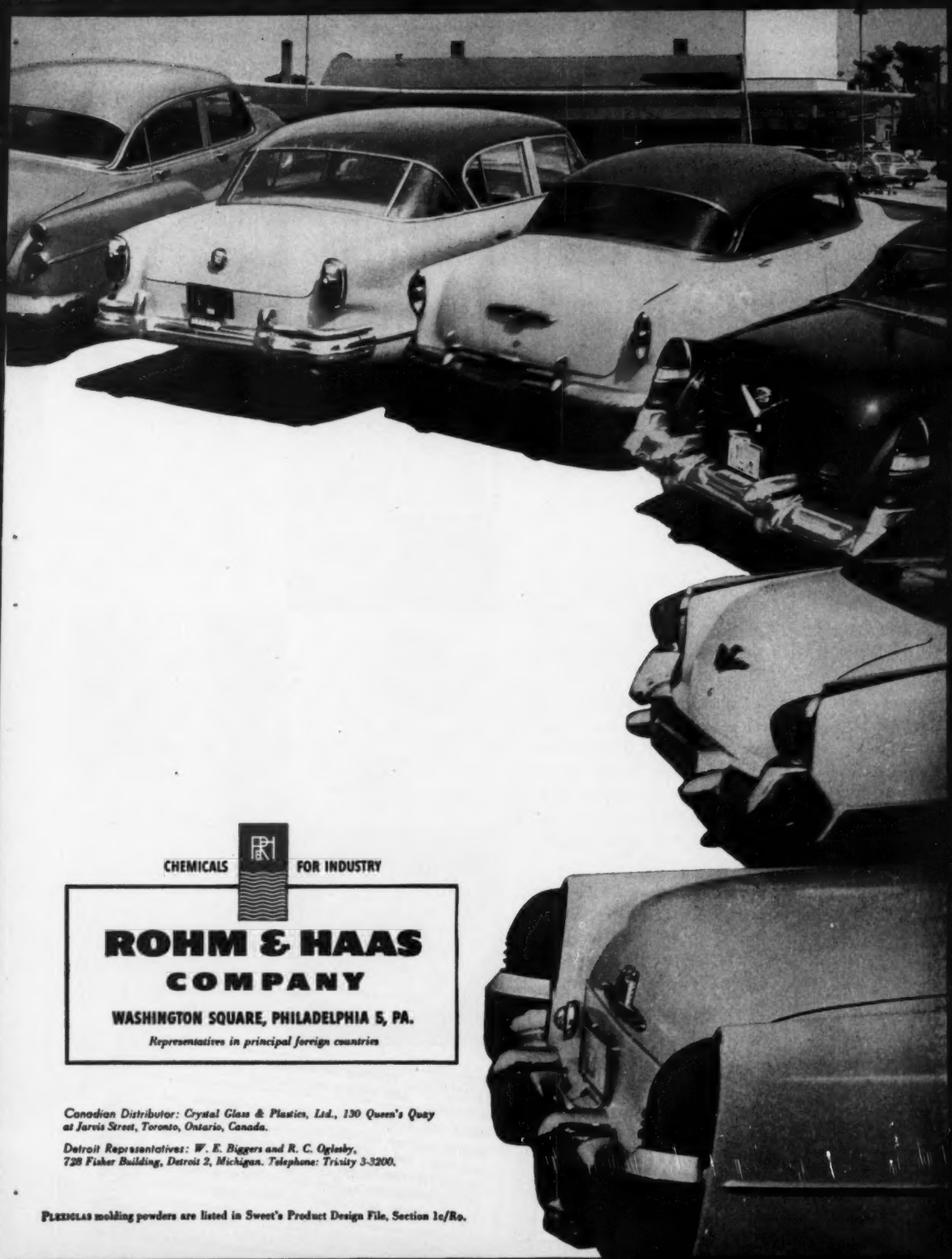
You can tell them by their tail lights of PLEXIGLAS

On many cars today, tail lights are as much a mark of identification as a nameplate. Designers have learned that PLEXIGLAS® acrylic plastic makes it possible to mold lenses in shapes and sizes that give added distinction to the over-all car design.

Other important advantages are obtained by using PLEXIGLAS. Tail lights, stop lights, direction signal and back-up lights function with maximum efficiency because the light-controlling curves and sharp angles of their lenses can be molded with extreme accuracy. PLEXIGLAS also gives them outstanding resistance to breakage, discoloration and weather.

In addition to lenses, molded PLEXIGLAS parts on modern cars include trademark reproductions, edgelighted instrument panels, and dials. These types of moldings are also being used widely in other fields, to increase the sales appeal of products such as television and radio sets, refrigerators, air conditioners, kitchen ranges and washing machines.

Our technical help is available to manufacturers and designers on problems—or ideas—involving molded parts.



CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

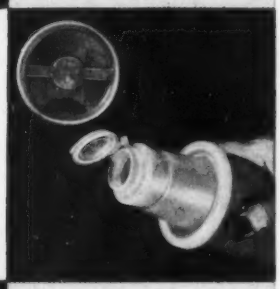
Representatives in principal foreign countries

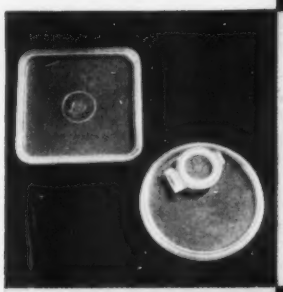
Canadian Distributor: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.

Detroit Representatives: W. E. Biggers and R. C. Oglesby, 728 Fisher Building, Detroit 2, Michigan. Telephone: Trinity 3-3200.

PLEXIGLAS molding powders are listed in Sweet's Product Design File, Section 1e/Ro.

NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!





Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

TUPPER!
TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

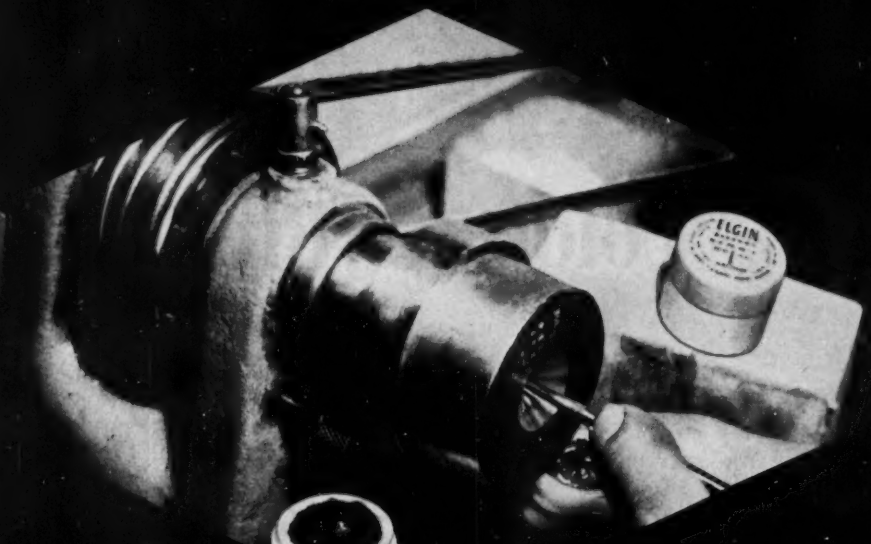
About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices:
Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q.
Showrooms: 225 Fifth Ave., N. Y. C.

Address All Communications To:
DEPARTMENT M-1



ELGIN DIAMOND

meets rigid quality standards

at Allegheny Ludlum Steel Corporation, Pittsburgh

When wire is pulled through carbide dies, tremendous heat and pressure are generated. That is why the working surfaces of wire drawing dies must be polished to a near perfect finish. That is why Allegheny Ludlum uses Elgin Diamond.

Elgin Diamond assures the finest possible finish—and in less time—because all Elgin Diamond is precision graded and permanently suspended in a color-identified compound right in the Elgin laboratories. There are no oversize particles to scratch, no "fines" to decrease cutting efficiency.

Hundreds of die finishing applications prove Elgin Diamond reduces costs and produces a better finish every time . . . in less time! Now is the time to try Elgin Diamond and prove it to yourself!

Ask for a free demonstration!

ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

Dept. M

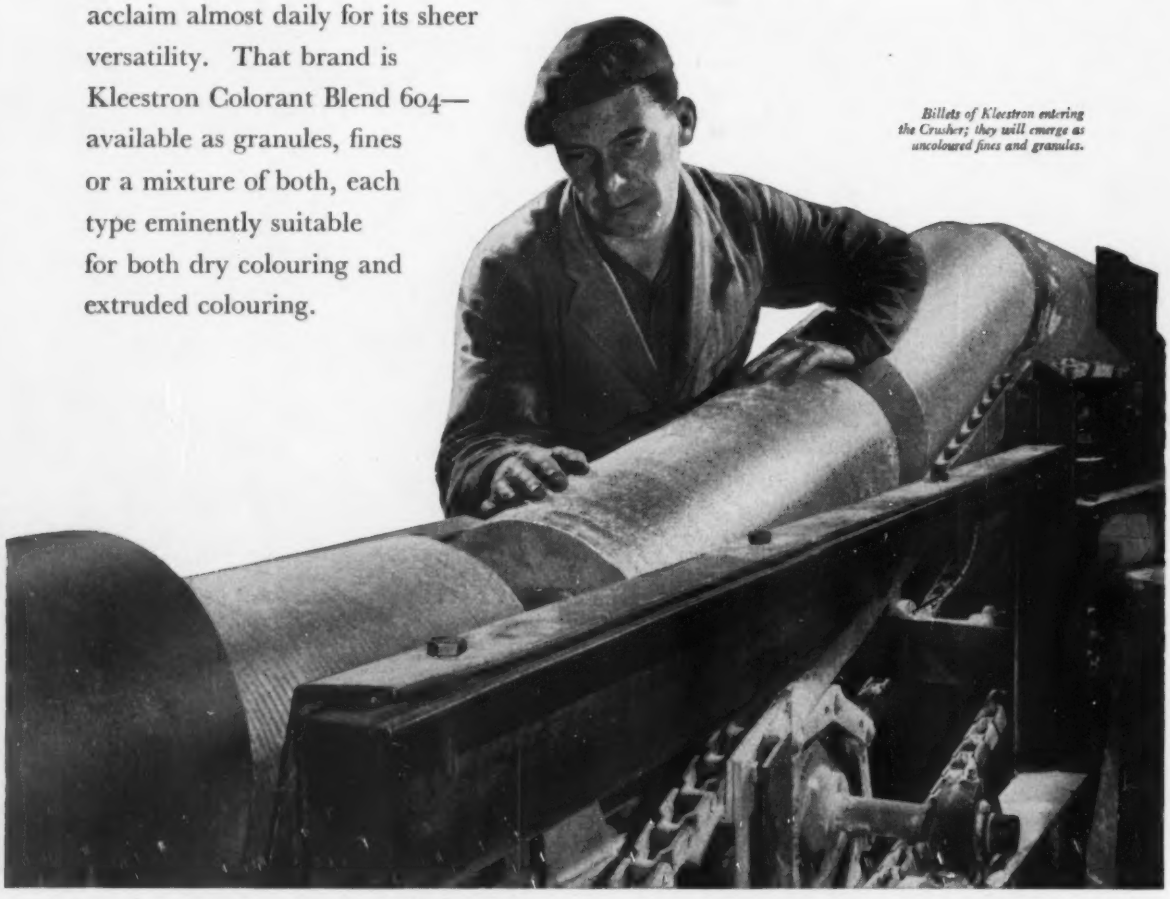
ELGIN ILLINOIS

KLEESTRON

Colorant Blend 604

the *VERSATILE* plastic

The world over, polystyrene is renowned for its cheapness, lightness and for the infinite number of ways it can be used. The world over, too, one brand of polystyrene is winning (and deserving) fresh acclaim almost daily for its sheer versatility. That brand is Kleestron Colorant Blend 604—available as granules, fines or a mixture of both, each type eminently suitable for both dry colouring and extruded colouring.



Billets of Kleestron entering the Crusher; they will emerge as uncoloured fines and granules.

Overseas and Export enquiries to—

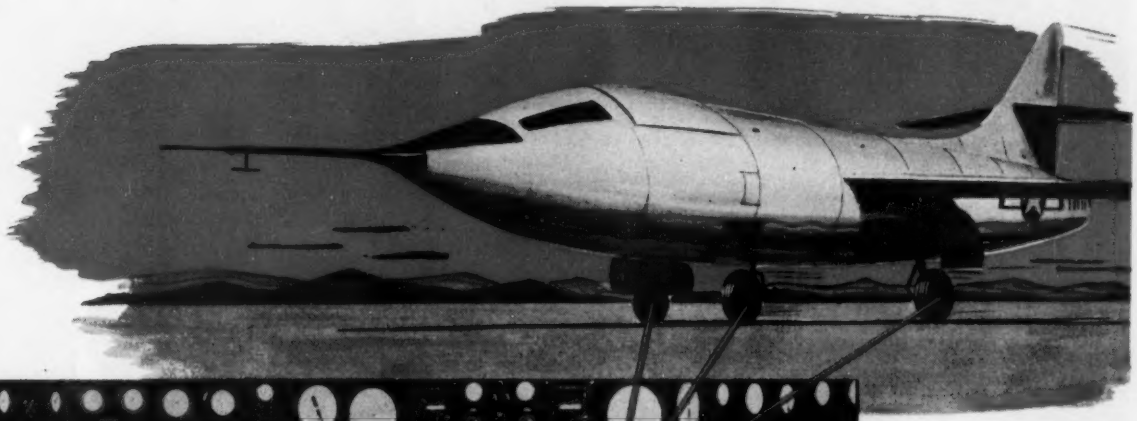
KLEESTRON LIMITED

WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON S.W.1 · ENGLAND

Telephone: SLOane 0866 *Cables: KLEEMABRO · LONDON*

FROM Kittyhawk TO Muroc

FROM LANDING SPEEDS OF 20 MPH TO 300 MPH



This Dynamometer Bench Board controls over 200 tons of complicated precision machinery comprising an ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINE. On it are recorded the results of tests made at landing speeds up to 300 M. P. H.

ADAMSON Engineering and Testing Equipment have kept pace with Aviation progress

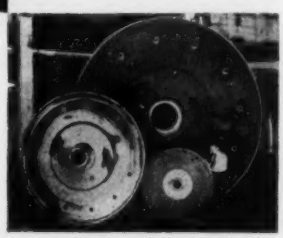
Adamson has designed and/or built complete, and installed, for the armed services and for commercial flying, more AIRCRAFT BRAKE AND TIRE TESTING EQUIPMENT than all other manufacturers combined. Adamson Testing Equipment is in use the world over; and Adamson Engineering is acknowledged pre-eminent in this field.

Among those Adamson serves as consultants or as designers and builders are:

The U. S. Navy
The U. S. Air Force
Bendix Aviation Corp.
General Tire & Rubber Co.
B. F. Goodrich Co.
Goodyear Tire & Rubber Co.
Schenuit Rubber Co.
U. S. Rubber Co.
Firestone Tire & Rubber Co.
British Ministry of Supply
French Ministry of Supply
N. A. C. A., and many others.

Whether you are in aviation or not, ADAMSON'S CREATIVE ENGINEERING and precision manufacturing facilities are available to you. Designing processes and building precision machinery for unusual and exacting requirements, has been Adamson's business for more than 60 years.

Your inquiry entails no obligation. Why not write today?



Some Inertia Wheels used in ADAMSON AIRCRAFT BRAKE AND TIRE TESTING MACHINES. Large wheel is 16 ft. in dia.; wt. 185 tons. Peripheral speeds to 200 M. P. H. Max. Vibration .0005 to .001 inch.

Adamson United Company
730 CARROLL STREET
AKRON 4, OHIO

Sales Offices in Principal Cities
SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY CO.
Plants at: Pittsburgh • Vandergrift • New Castle
Youngstown • Canton

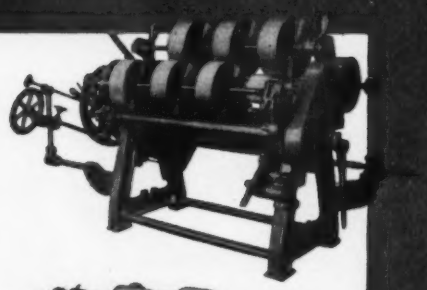
Adamson United

AIRCRAFT BRAKE AND TIRE-TESTING MACHINES

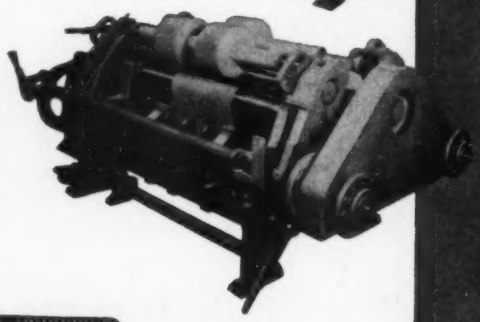
Get the Right
FILM SLITTER

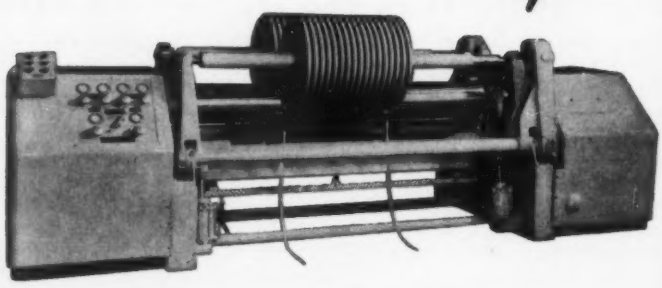
First, consider your roll production requirements. Then consult with Cameron engineers. Investigate modifications designed to meet your exact slitting and roll winding needs. You'll wind up with a machine custom-fitted to your job — a CAMACHINE!

TYPE 26 — For light to heavy gauge plastic films. Rated at speeds up to 500 fpm. Score-cut slitting; combination surface and center rewinding; positive roll separation.



TYPE 28 — For light to heavy gauge plastic films. Rated at speeds up to 800 fpm. Choice of score-cut or shear-cut slitting; combination surface and center rewinding; positive roll separation.





TYPE 29 — A heavy-duty machine rated at speeds up to 1500 fpm. 36" diameter rewind capacity. Score-cut slitting; combination surface and center rewinding; positive roll separation.

BELOW: A few of the modifications available on the popular CAMACHINE Type 26 Slitter-rewinder.

26-R-7 — razor blade slitting at speeds up to 700 fpm.

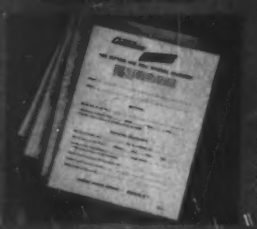
26-7 — score-cut slitting with built-in automatic web tension.

26-31 — Scobut® — heat seals edges of strips instantly as it cuts.

26-S(SR) — both score-cut slitting elements and razor blade slitting attachment.

CAMACHINE SATELLITE

Let this specialized team get a package machine tailor-fit to your application for your roll processing job, while using cut-to-size rolls of the Satellite.



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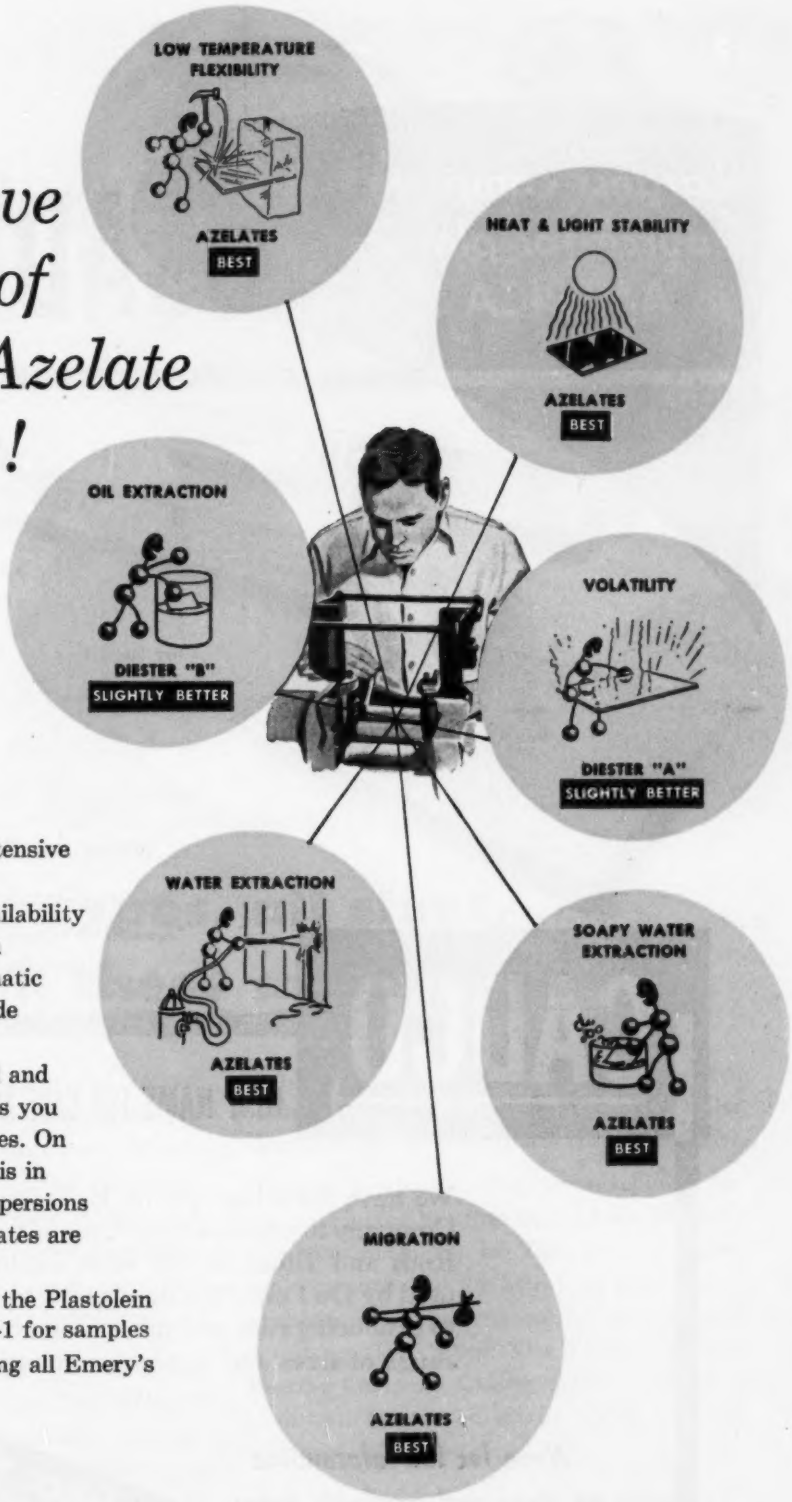

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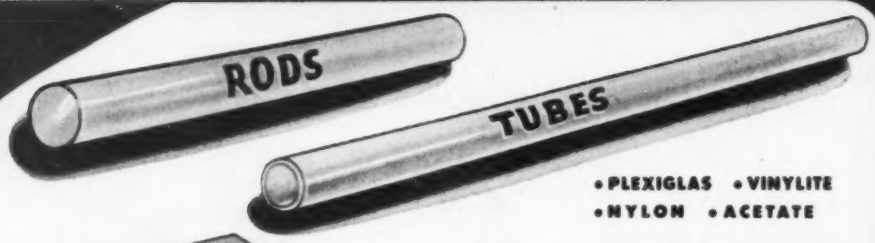

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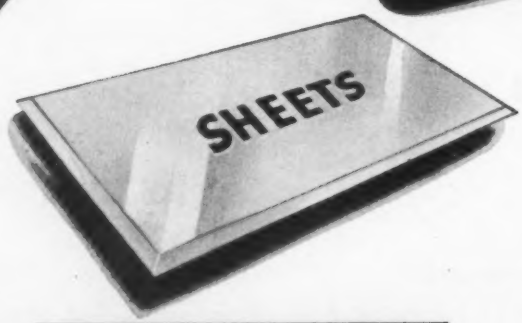

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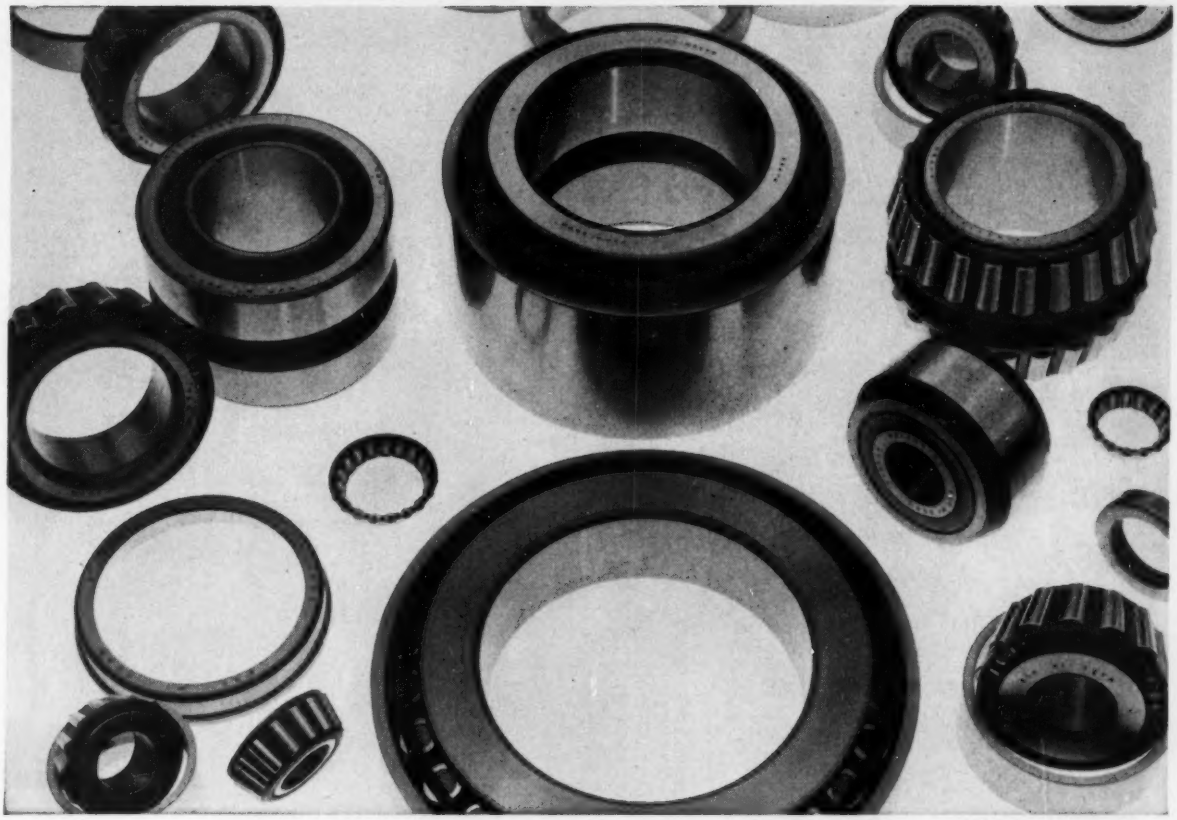

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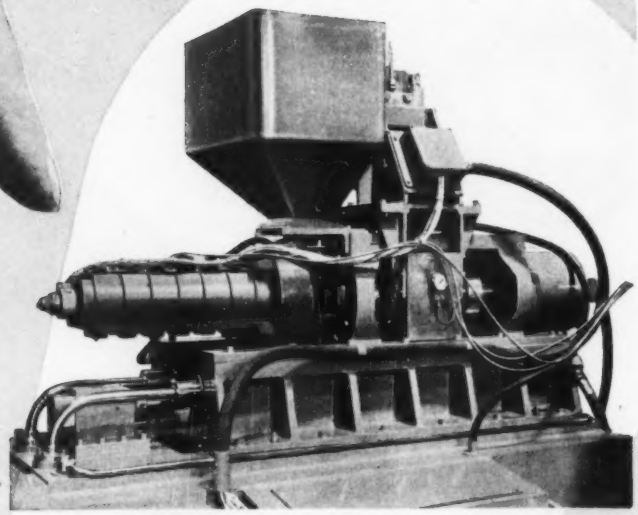

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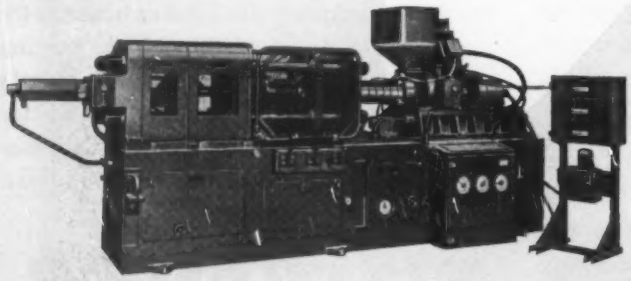

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"EVENGLO® polystyrene is our specifications standard in Sylvania lighting fixtures."

says George Clark
Chief Engineer
Fixture Division
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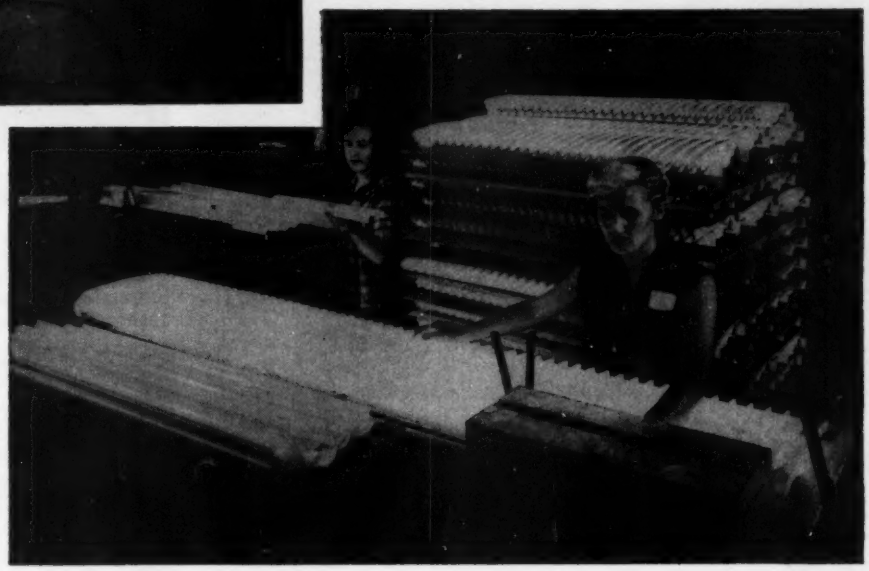

Fixture production line at Sylvania Electric Products, Inc., Wheeling, W. Va.

POLYSTYRENE panels are an important part of a lighting fixture. They must evenly diffuse the light from the fluorescent lamps so that illumination will be high — yet the plastic panels themselves must not be too bright.

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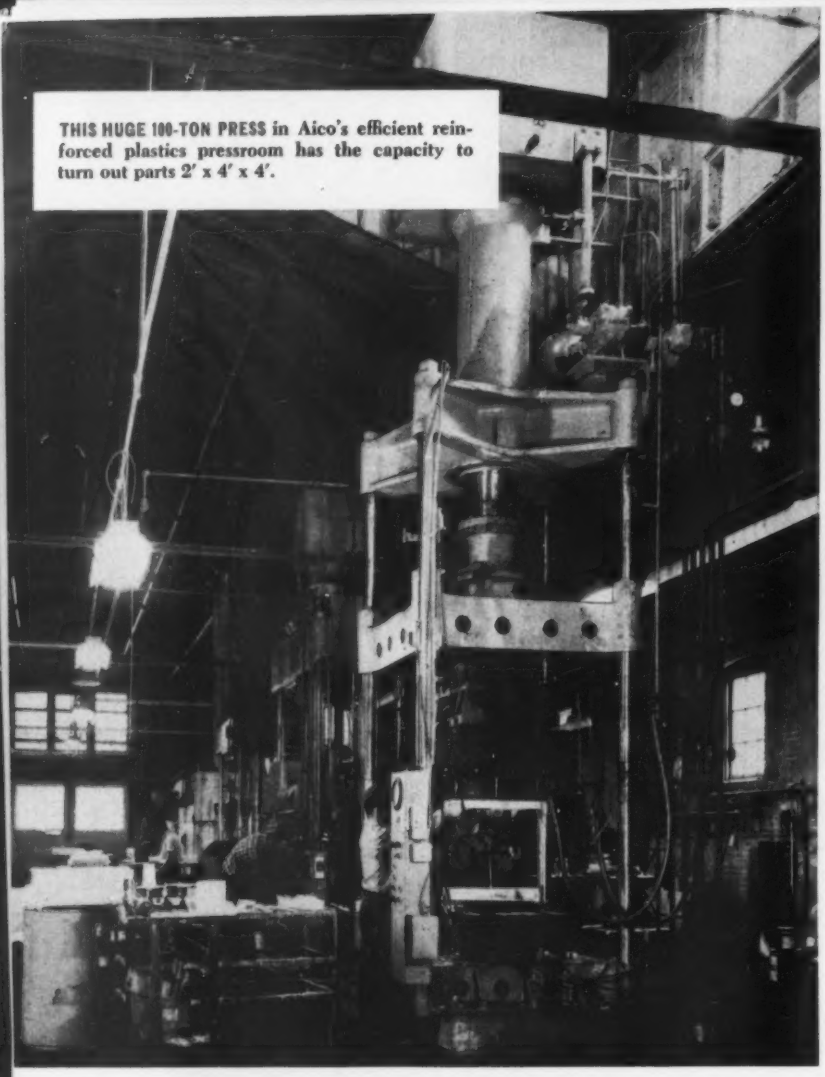
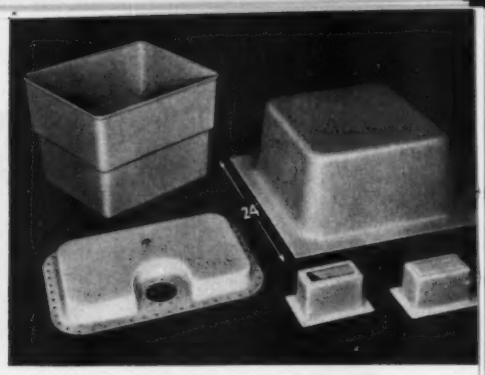
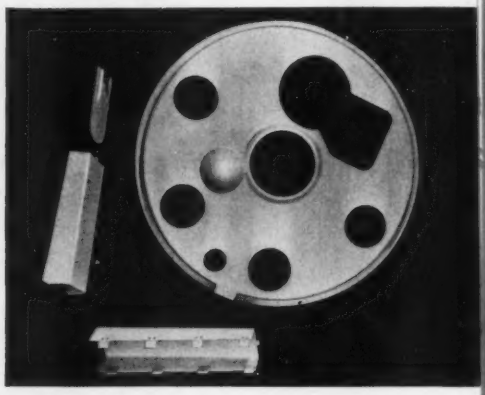


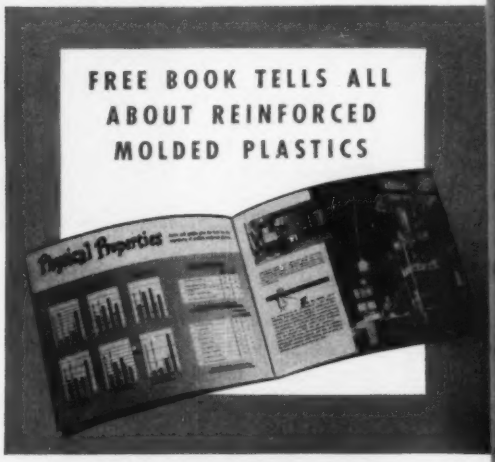
THIS HUGE 100-TON PRESS in Aico's efficient reinforced plastics pressroom has the capacity to turn out parts 2' x 4' x 4'.



GLASS FIBER PREFORMS offer exceptional strength for tote boxes, trays and containers. Reinforced plastics were specified for the large 24" form because of light weight and dimensional stability.



GLASS FIBER MAT MOLDINGS. Large circular piece is a cover for radar equipment. Complex shape required no hand work or punch press. This material offers ease of production, great strength plus transparency to electronic impulse.



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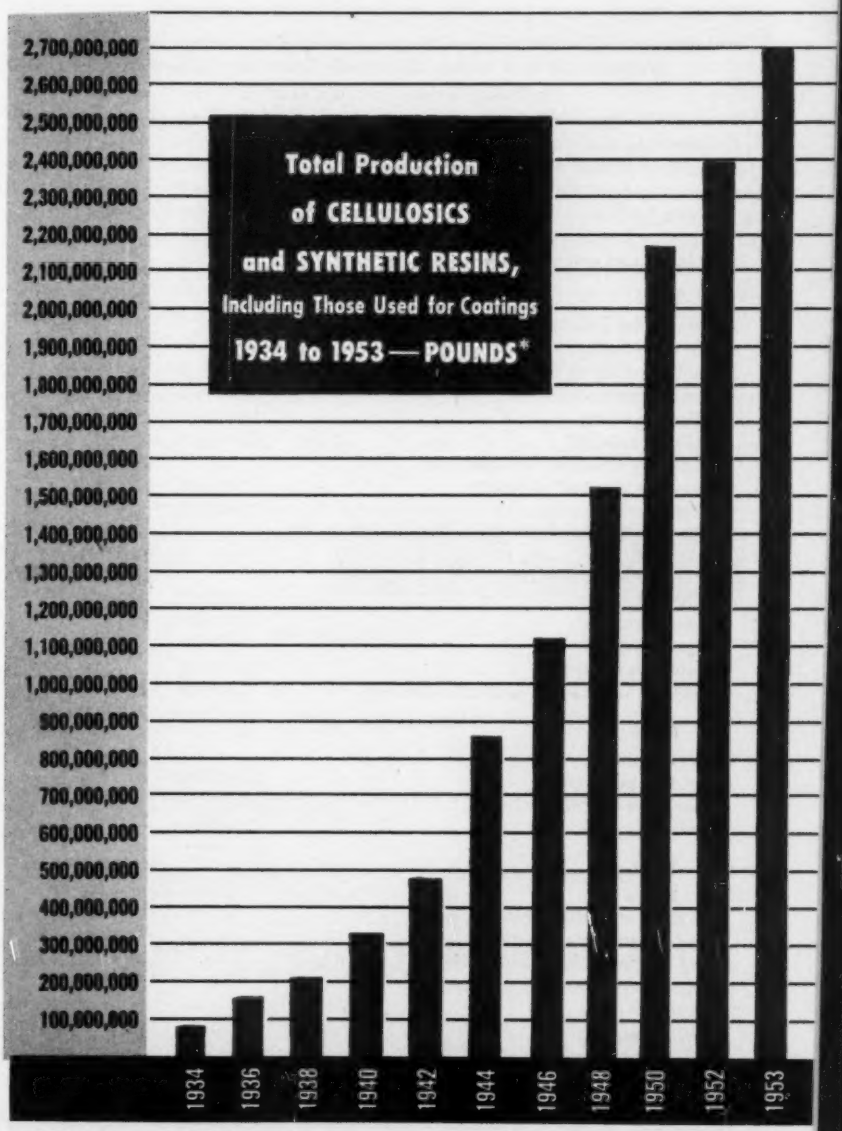
NEW FREEDOM, PENNSYLVANIA

Progress in Plastics

THERE were few persons back in 1940 who were daring enough to predict that the synthetic resin and plastics industry would reach an annual production rate of over 2½ billion lb. in 12 or 13 years' time. Indeed, if all the compounding material which is added to a resin base, plus camera and movie film, plus synthetic fiber resins (exclusive of rayon), were added, the total would be pushing 3 billion lb. today. Furthermore, many of the synthetic resins are continuing to show volume increases that exceed nearly all other branches of American industry.

The chemical industry as a whole has been growing at an average increase of 10% a year in contrast to the national economy's growth of 3% per year. That difference in growth could mean that the chemical industry would be less affected than most other industries by any future recession in general business. Thus, if all business should decline 10%, the chemical industry might decline only 2 or 3 percent. The reason is that new chemicals and new uses for old chemicals are constantly coming on the market. In addition to being a hedge against recession, these new developments are also responsible, of course, for a large part of the chemical industry's huge expansion program.

Plastics and synthetic resins are highly important factors in the chemical industry. For example, the expansion plans for benzene, phenol, formaldehyde, styrene monomer, and many other but smaller volume chemicals are based in great part upon estimated future potentials



* Sources: U. S. Tariff Commission and MODERN PLASTICS estimates.

for plastics. These potentials lie in latex coatings; shell molding; vinyl floor coverings; plastics pipe; resin bonded waste wood and mineral wool; film for packaging; and numerous other less publicized products. When these are added to the normal growth expected from long established plastics products, the total is expected not only to serve as a bulwark against a possible depression but also to insure an ever-increasing volume of both new and old plastics products for many years.

The largest amount of synthetic resins consumed by any one industry is that used by the paint, varnish, and lacquer industry, or the so-called surface coatings industry. It wouldn't be surprising if the official tally for 1953 should show around 700 million lb. of resin for such uses. These, of course, include such things as sprayed cocoons, can linings, anti-corrosive coatings of various kinds, baked-on enamels, and just ordinary paint.

The tremendous increase in styrene-butadiene latex for use in the so-called water or rubber paints is highly significant. It has grown from a few million lb. of resin to over 80 million in three or four years' time. In 1953 it was estimated that these paints accounted for 12 or 15% of all the paint, varnish, and lacquer produced in this country. Heretofore, their use has been largely confined to interior work, but certain formulations for outdoor work are now on the market.

The paint industry is not generally considered as a part of the plastics industry, but statistics of the paint and plastics industry are so closely interlinked that it is difficult to make an accurate separation. If all resin used for paint, varnish, and lacquer were deducted from the total of all resins sold in 1953, it is probable that the amount sold for use in plastics products would be under two billion pounds.

Styrene resin sales are the second largest volume item listed in Table A. As noted before, the rise in latex production was a big factor in that situation, although molding material production increased from 248 million in 1952 to approximately 300 million lb. in 1953.

Vinyls of all types are third on the list. That listing includes saran, polyvinyl butyral, polyvinyl acetate, polyvinyl alcohol, polyvinyl formal, polyvinyl acetal, and some minor materials; but by far the largest is polyvinyl chloride and vinyl chloride-acetate copolymers. The chlorides accounted for over 360 million lb. of the total vinyl sales. Polyvinyl acetate is estimated to have been about 40 million lb., exclusive of that used for chloride copolymer, and is expected to grow rapidly as a material for latex paint; butyral had a record year—perhaps 20 million lb. including the plasticizer used with it. Polyvinyl alcohol and saran sales figures are not known and estimates are unreliable.

Phenolic compound advances in 1953 were led by a substantial increase in molding powder sales—a record year, in fact. Laminating resin sales were higher than usual due to an increase in production of decorative laminates. Attention might be called to the 25 million lb. or more of phenolic sold as a binder for mineral wool used in thermal insulation. Heretofore, the amount of resin used for that purpose had been a well kept secret.

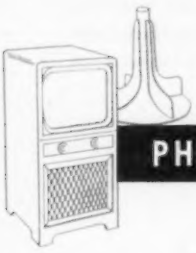
The miscellaneous group includes some 135 million lb. of polyethylene and unknown quantities of acrylics, nylon, epoxies, fluorocarbons, alkyds used for molding material, and various other miscellaneous types not classified.

Table A—Sales in Pounds of Synthetic Resins and Cellulosics, Including Surface Coatings, in 1953[a]

Cellulose plastics		
Cellulose acetate and mixed esters		
Sheets under 0.003 gage	15,100,000	
Sheets 0.003 gage and over	13,000,000	
All other sheets, rods, and tubes	5,100,000	
Molding and extrusion materials	73,300,000	
Total		106,500,000
Nitrocellulose sheets, rods, and tubes		6,500,000
Other cellulosics		6,400,000
Phenolic and other tar-acid resins		
Laminating resins	77,000,000	
Adhesive resins	39,000,000	
Molding material	210,000,000	
Protective coatings (straight and modified except by rosin)	27,000,000	
Resins for other uses	79,000,000	
Total		432,000,000
Urea and melamine resins		
Adhesive resins	74,000,000	
Textile treating	31,000,000	
Paper treating	22,000,000	
Protective coatings	20,000,000	
Molding, laminating, and miscellaneous	77,000,000	
Total		224,000,000
Styrene resins		
Molding materials	300,000,000	
Protective coatings	88,500,000	
Resins for other uses	75,000,000	
Total		463,500,000
Vinyl resins all types including chloride, saran, butyral, polyviny[l] acetate		460,000,000
Alkyd and rosin modified coatings		440,000,000
Coumarone-indene and petroleum polymer resins		160,000,000
Miscellaneous types		263,000,000
GRAND TOTAL		2,561,900,000

[a] Source: U. S. Tariff Commission, first eight months 1953; last four months estimated.

Trends in Materials Use



PHENOLICS

STRANGE patterns have been established in the phenolic industry during the past three years. When business was good, the ratio of increase in phenolics was generally a little better than in most other plastics; when business was bad, the phenolics generally suffered a little more than other plastics. These patterns are even more mysterious since phenolics have been around long enough to establish a dependable course of procedure and their uses, insofar as molding material is concerned, haven't changed much for several years. Once in a while something like television cabinets will come along to give added impetus but the 1953 increase was certainly not due entirely to television.

Since 1951, monthly sales of phenolic molding powder have ranged from a low of 9 million lb. in June, 1952 to a high of 21 million lb. in April, 1953. When the industry can stay up around 200 million lb. a year, as it did in 1947, 1950, 1951, and 1953, both molders and suppliers are content but the griping becomes a mournful wail when sales go down to 160 million lb., as they did in 1952.

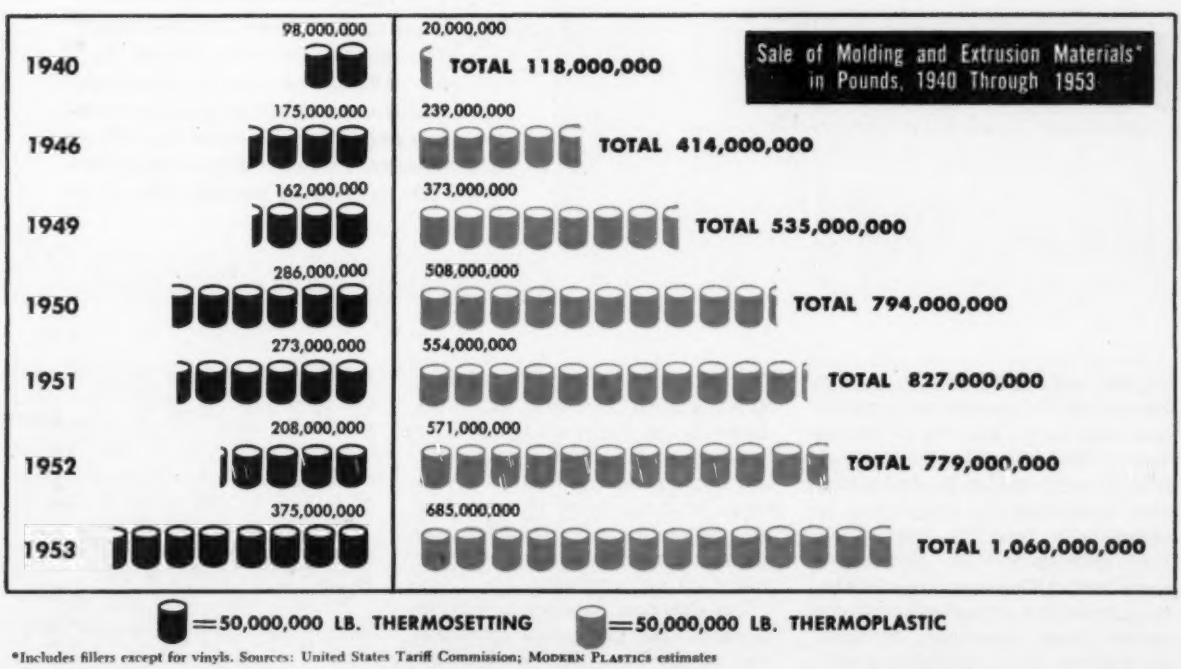
The first half of 1953 was a remarkable period with sales never dropping below 17 million lb. in one month. The total for the period was over 115 million pounds. There was much hope at one time that the industry would show the usual increase in the second half and more than equal the first six months' sales figures. However, good as they are, the phenolics weren't quite good enough to overcome the mild decline in general business. Consequently, the last six months' total was smaller than the first; however, the final sales figure of around 210 million lb. puts 1953 down as the best year in history.

Optimists believe that the year is not far distant when phenolic molding materials may average from 20 to 25 million lb. monthly, but others point out that the phenolic industry is so closely integrated with the over-all national industry that such an increase cannot be expected until the national economy expands considerably above its present level.

Along this line it is interesting to note that Durez has announced that a new 64 million lb. capacity plant at Kenton, Ohio, will start production in the summer of 1954. New type labor saving devices will be installed with the result that a low-cost operation may be expected.

Growth Possibilities

Those optimists who believe that phenolics may grow faster than the index for all national manufactur-



*Includes fillers except for vinyls. Sources: United States Tariff Commission; MODERN PLASTICS estimates

Highlights of the Plastics Picture

PHENOLICS

Molding powder sales increased from 158 million lb. in 1952 to around 310 million lb. in 1953, the highest volume ever reached. Laminating resin use grew from 69 million to 77 million pounds. Increase in molding material was spread between traditional applications; laminating rise came mostly from decorative laminates.

ACRYLICS

Automotive industry continues to absorb more molded acrylics for medallions and light lenses each year. Same idea is developing for use on refrigerator and other appliance handles. Signs continue to use more cast sheet than any other civilian application. Extruded sheet is not yet big volume.

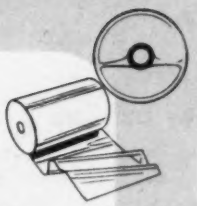
POLYSTYRENE

Nearly 300 million lb. of molding powder sold in 1953 in comparison to 248 million lb. in 1952. Over half of all polystyrene sold is expected to be of high impact type in near future. Housewares and refrigerator parts are leading applications. Wall tile is making remarkable gains.

ing, and reach a 250-million or even 300-million lb. annual consumption rate, base their reasoning on several factors. First, phenolics have grown from 50 or 60 million lb. during war time to the present 200-million lb. figure in a brief 10 years' time. They have successfully met threatened competition from other materials. Improved compounds are constantly being developed. In many applications, such as handles, a considerably larger amount of phenolic is being used for each unit produced. Large size moldings, such as housings and furniture units, are still in their infancy. Particular segments of the national industry that use quantities of phenolics are growing faster than some of those that don't use phenolics.

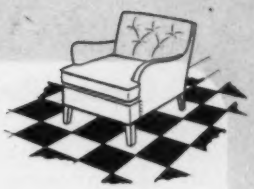
The electrical industry is a prime example. The per capita consumption of electricity increased almost twice in the decade between 1940 and 1950. Electric ranges more than tripled in that period; output of electric refrigerators and radios doubled; telephones increased from 22 million in 1940 to 46 million in 1951; the electronic industry grew from a half-billion-dollar business in 1940 to six billion in 1953.

Phenolic parts are also used in the synthetic textile, chemical, automotive, closure, and other indus-



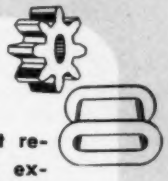
CELLULOSICS

Cellulose acetate increase was sparked by demand for thin film. Molding material won back several markets. Cellulose acetate butyrate made usual steady gain, is now making bid for good portion of plastics pipe market. Both materials on way to producing clear sheet for volume use in vacuum molding.



VINYL CHLORIDE

Volume increased from 340 million lb. in 1952 to over 360 million lb. in 1953, even though film and sheeting consumed less resin than in former years. Largest increases were in material for floor coverings, which grew from 12 million lb. in 1952 to 25 million lb. in 1953, and fabric coating which expanded from 38 to 48 million pounds. Growth of film industry was hampered by a chaotic price structure. Rigid vinyl is expected to come into big volume in the near future.



NYLON

One of toughest and higher heat resistant thermoplastics is making excellent progress. Long life and superb performance make a nylon product less costly than metal in many applications. It is a possible replacement wherever brass is used. Has wide versatility—bearings, wire coating, soft hammer heads . . .

POLYETHYLENE

Fastest growing plastic of all time, polyethylene was scarce all year. Capacity increased from 10 or 11 million lb. a month to 16 or 17 million lb. late in year, will be increased by 8 or 9 million more in late summer of 1954. Several new producers assert they will have additional capacity ready for production by end of 1954. Of the 135 million lb. produced in 1953, about 40 million lb. was for film and nearly the same amount for electrical purposes. Polyethylene low cost, unbreakable toys now beginning to reach the market.

UREA AND MELAMINE

Spearheaded by melamine dishware, urea and melamine made modest gains. Wiring devices, closures, and buttons led urea parade. Adhesives in 1953 were less than in 1952 due to slump in furniture industry. One of two largest urea producers changed ownership.

tries where volume is not comparable to that used for electrical purposes, but in which the total is nevertheless not insignificant.

One of the largest outlets for phenolic molded pieces is electrical control parts—things like circuit breakers, panel boards, and instruments used in power plants and wherever electrical current is generated or distributed. Assemblies of 20 to 30 lb. are common in such usage. Estimators say that it is impossible to give a reasonably accurate guess on the poundage used in these applications per year but volume will continue to grow in proportion to the ever increasing production of electrical energy.

Another large use of phenolic molding material is in housings for such products as television sets, radios, fans, and meters. As much as 40 million lb. is thought to have been used for this purpose in 1953. The biggest portion of that 40 million lb. was used for television cabinets. Several more companies have added phenolic cabinets to their line since 1952 and those that were already in have increased their volume of plastic cabinets. An increase in size is also noticeable. The older cabinets used some 5 to 10 lb. of phenolic; new ones go to 34 pounds.

On the other hand, the phenolic

Estimated Phenolic Consumption in 1953, by End Uses

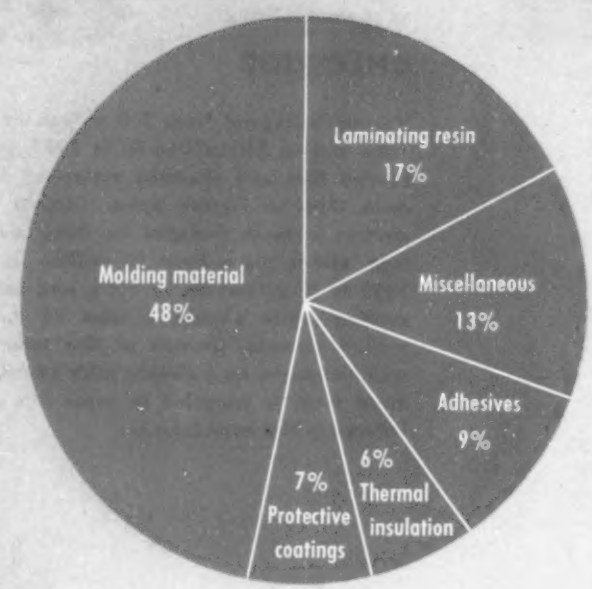


Table B—Phenolic Resin Sales in Pounds[a, b]

	First 8 mo. 1953	*Estimated last 4 mo.*	*Total 1953*	*Total 1952*	*Total 1951*
Laminating resins[c]	51,200,000	25,800,000	77,000,000	68,800,000	74,200,000
Adhesive resins[d]	27,400,000	11,600,000	39,000,000	39,700,000	38,000,000
Molding material	144,900,000	65,100,000	210,000,000	158,400,000	205,000,000
Protective coatings (straight and modified, except by rosin)	18,100,000	8,900,000	27,000,000	24,000,000	23,400,000
Other uses[e]	50,900,000	28,100,000	79,000,000	61,400,000	71,200,000
TOTAL			432,000,000	352,300,000	411,800,000

[a] Source for 1951, 1952, and first eight months 1953: U. S. Tariff Commission; last four months 1953 estimated.

[b] All on a solid resin basis except molding compound, which includes slightly over 50% filler.

[c] Production figure used instead of sales figure because most laminating firms make and use large quantities of their own resin.

[d] Several plywood companies produce their own resin, consequently there are several million pounds of adhesive resin *not* reported as sales.

[e] Includes resin for thermal insulation bonding; brake linings; abrasives; foundry cores and molds; rubber reinforcement; waste wood bonding; solid resin sold to firms who make their own molding material; and small quantities for miscellaneous purposes.

radio cabinet business has taken a nose dive. Not only has cabinet production dropped from 14 million in 1947 to 6½ million in 1952 but styrene and urea have taken over 60 to 70% of what business was left in portables and clock models.

Some phenolic was also used in room air conditioners. The industry hopes to obtain a much larger share of this business in the future. Some 650,000 room coolers were expected to be sold in 1953 and production is expected to increase to between one and two million units a year.

Wiring devices are probably third on the 1953 phenolic consumption list but for some unaccountable reason they started to decline early in the year. It may be that there was a surplus inventory in the hands of electrical supply houses or that a slowed-up home building program caused the lull. Some 30 million lb. could easily have filled this use in 1953; there have been years when wiring devices consumed 25% of total production.

Closures are thought to be fourth on the phenolic list. Volume was between 20 and 25 million pounds. This is a good phenolic application that has withstood severe competitive threats from other materials but never seems to change much in volume from year to year.

Appliance Consumption

Household appliances are next in volume. If appliances were combined with all kinds of handles, the phenolic volume consumed by these two outlets would exceed that of closures. Electric iron handles alone probably use more phenolic than the automotive industry. Not only are there many times more phenolic handles of all kinds now in use than ever before but practically every one of them consumes from two to four times more material than when first made in phenolic. No exact figure is available but producers guess that volume for handles of all types is well over 20 million pounds.

Telephone hand sets follow next in volume use. Then come washing machine agitators, with a consumption of 9 or 10 million pounds.

The automotive industry is estimated to have used about 8 million lb. in 1953. Cars and trucks use a little over a pound per car for such parts as distributor caps, rotors, coil tops, and sleeve connectors.

Another sizable market is the 6 or 7 million lb. used annually for vacuum tube sockets. This has been another good, solid use that has resisted many threats from the "fancy pants" plastics and other materials.

Still other million-or-more-lb. outlets are caster wheels and camera parts. The miscellaneous list, including office equipment and textile machine parts, is big. Yet back of 1953's progress and profit is still a fear in the minds of industry leaders—a fear that the industry has not done enough to prepare for rainy days when times get tough. Everyone goes blithely along without worry in 1953 and forgets how they moaned in 1952 and 1949. Not enough work is being done to find new products. It is painfully obvious that phenolic products today are almost the same as they were years ago. Even the television cabinet is mostly an extension of the radio cabinet idea. But it hasn't yet

spread in any quantity to other products. Development of phenolic products to compete with metal, particularly in housings, has barely started, despite potential cost advantages. But it is along this line that the industry has its best chance for big volume increases.

Laminating

The laminating branch of the phenolic industry also had a good year —the best since World War II and almost as good as the highest wartime year. A great part of this progress was due to the increasing use of melamine or decorative laminates which some estimators say was 30% of the total high-pressure laminating industry. One resin producer insists that between one hundred and one hundred twenty million square feet of 1/16-in. decorative sheet was produced in 1953. He maintains that this 8 ply lay-up would require approximately 36 million lb. of phenolic varnish, or somewhere near 24 million lb. of solid resin. The reader will note that this is more than the one-third of the total laminating varnish mentioned by other estimators for decorative laminate cores, but the figure serves to point up the difference of opinion in the industry as well as the growing importance of decoratives. Unfortunately, no statistics on the decorative laminating industry are available and no two processors agree on a total.

But on one conclusion they are all unanimous. This is that decorative laminates show signs of growing far beyond their present volume. Currently they have less than 5% of the potential horizontal market in such products as dinette sets, counter tops, drain boards, and furniture. The vertical market for such uses as wall covering, doors, and other structural applications is barely scratched. An interesting product revived last year was a melamine topped, phenolic core, laminated wall tile 1/16 in. thick. Claims are made that this decorative wall tile can be sold at from 36 to 40¢ a sq. ft. in comparison to a mail order house thermoplastic wall tile at 46¢ a square foot.

A possible radical change in varnishes also appeared in 1953 with the introduction of water soluble varnishes instead of the traditional alcohol solution. The new type varnish is recommended only for the cores of decorative laminates. It is less costly and easier to handle—requires no expensive solvent recovery system and has an especially good tolerance for extenders.

Laminators are quite happy over the upsurge in decorative laminates since industrial laminates have not shown much indication of growth for several years. The electrical industry will always use large quantities; the textile industry is gradually increasing its use of laminates; one laminator at least is having good success in selling a laminate for name plates, rigid maps, and similar vertical uses where long-time wearability is a necessity; but by and large there has been no expansion in industrial laminates since World War II.

Phenolic resins other than mold-

(*Continued on p. 157*)

UREA and MELAMINE

INCREASING use of melamine molding powder for dishware and melamine varnish for laminating were perhaps the most satisfactory developments of the year. Textile resins declined because of a drop in the textile industry itself. Readers should note that the textile resin figure given by the U.S. Tariff Commission in its monthly reports is always considerably lower than the revised annual figure because several small producers report only on an annual basis. There is also considerable dispute in the industry about the figures for adhesives.

Molding powder sales of urea and melamine in the first half of 1953 were the highest in history for any similar period. There was a slight decline in the last six months due to the usual slow market in the summer and the general decline of all business in the latter half of 1953. However, this was a lesser drop than for almost any other plastic.

A substantial part of the good showing in 1953 was due to the ever-increasing use of melamine for dishware. Some estimators place the 1953 probable figure at 15 million or more lb., compared to 10 or 12 million lb. in 1952. American Cyanamid officials politely decline to make an estimate.

It is believed that the dishware market takes somewhere near 90% of all the melamine molding material that is produced. Buttons are coming along nicely and increasing in poundage each year, even though they cost 30 to 35% more than urea buttons. One advantage is that they have extra good washability. However, a few hundred thousand pounds of melamine can make millions of molded buttons.

There is as yet no indication of a rapid rise in melamine molding material use in the near future; nothing is in sight that will compare to the impetus of dishware. Higher cost in comparison to many other molding materials is the chief reason. Technicians are still working on the possibility of producing a lower cost melamine from urea crystal, but no progress report has been made public. The margin of cost between melamine and phenolics has narrowed over the years as phenolic prices increased slightly and melamine remained the same, but until that margin becomes smaller, there is little chance of melamine edging into the phenolic market or into some of the thermoplastic industry's markets.

Volume of Urea

Urea molding powder volume in 1953 is estimated to have been between 40 and 45 million pounds. Urea products are much the same as they have been for years. Buttons, closures, and wiring devices are the leaders, with the top spot alternating between the first two. Stove handles are the next in volume importance.

Promotional campaigns to increase urea wiring devices and large molded pieces have helped to some degree, but fell short of expectations. The wiring device campaign ran into a general slump—phenolic wiring devices were likewise affected. Perhaps this situation was due partly to the slight decline in construction of new houses; on the

Table C—Urea and Melamine Resin Sales in Pounds[a]

	First 8 mo. 1953	*Estimated last 4 mos.*	*Total 1953*	*Total 1952*	*Total 1951*
Adhesive resins	53,000,000	20,000,000	74,000,000	79,000,000	75,100,000
Textile treating	20,300,000	10,700,000	31,000,000	37,000,000	29,400,000
Paper treating	14,800,000	7,200,000	22,000,000	23,100,000	17,800,000
Protective coating resins (straight and modified)	14,900,000	5,100,000	20,000,000	19,100,000	17,500,000
Molding, laminating,[b] and miscellaneous	51,500,000	25,500,000	77,000,000	62,700,000	74,500,000
TOTAL			224,000,000	220,900,000	214,300,000

[a] Source for 1951, 1952, and first eight months 1953: U. S. Tariff Commission; last four months estimated.

[b] Includes filler for molding material. Melamine for molding and laminating, plus miscellaneous uses, such as urea for sand cores, is estimated at between 23 and 28 million pounds.

other hand, there is some indication that a larger than usual inventory build-up in early 1953 affected sales later in the year.

The attempt to use more urea in large moldings made some slight progress, but the effort to move into the television cabinet market has not yet materialized. This seems like a logical application in which urea's color possibilities could be neatly realized. However, molders as well as television set producers apparently are not yet convinced that urea is another material with which they can vary their line of cabinets. But urea is getting into portable radio set cabinets and that may be a harbinger of more things to come in the urea housing market.

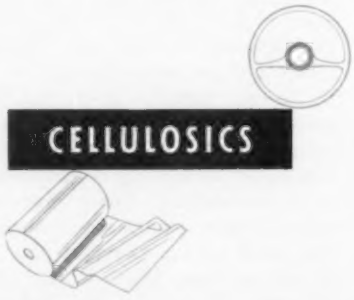
Urea toilet seats seemed to be more prevalent on the market than in former years, with several manufacturers specializing in products that emphasized quality rather than low cost. This development could turn out to be a good lesson to the plastics industry where low-cost items produced on a mass scale have sometimes not only wrecked the existing market, but have spoiled prospects for the future as well.

Low-Cost Urea

The low-cost 18¾-cent black and brown urea molding powder which was introduced a couple of years ago made fair progress but was no sensation from a sales point of view. So far, it has been confined entirely to electrical uses. Products like this sometimes slumber along for years until someone "discovers" them as just the ticket for a big-volume application; then they zoom into big volume importance.

Biggest item in the miscellaneous group under this category is melamine laminating resin, used primarily for the "color" sheet in decorative laminates. Estimators place a figure of 8 or 9 million lb. of melamine solid resin as being used for this purpose in 1953. This type of laminate is discussed under "Phenolics" in this review, but the key to the situation is the melamine sheet because it

(*Continued on p. 160*)



TOTAL consumption of cellulose acetate and cellulose acetate butyrate materials in 1953 just about tied the record of 1950 when 108 million lb. was consumed. This does not include film used for camera, movie, and X-ray purposes, which figure is not disclosed by the producers. The combined molding and extrusion material volume of 73 million lb. in 1953 is well below the record marks of 83 million in 1946 and 80 million in 1950 but is far above any except those two years.

The growing use of film for purposes other than those mentioned above has kept the cellulosics industry's consumption rate close to 100 million lb. annually. Extruded continuous thin film of less than 3-gage thickness has contributed to this situation but is by no means the dominating influence. Its properties are a mite less satisfactory than those of cast film, and technicians have not yet been able to eliminate the gel spots that sometimes mar its surface. Principal influence in acetate film growth seems to be purely and simply an increased public demand for a useful product.

Film use has grown steadily since 1946, when it was a 15 million lb. product, to its 28 million lb. volume in 1953. Up until the middle of 1953, supply was two or three months behind delivery. Orders started to drop off in the fall in an apparent customer desire to reduce inventories, and buyers would no longer make long-term commitments. At least a 10% increase in film volume is expected for 1954.

One reason given for the good position of acetate film is that merchandisers have accepted it as an aid to selling—especially when the market is slow. They seem to have learned that wrappers and acetate boxes for soft goods are good promotion. Perhaps that may be taken as an omen to indicate good film and sheeting sales when general retail sales are down.

A related increased use for acetate film was in windows for paperboard boxes. As a wrapper for fruits and vegetables where moistureproofness is not a factor, but breathing is, acetate film is gradually assuming an improved position. For lemons, limes, tomatoes, and especially mushrooms, it has proved highly desirable. On the West Coast, where spinach moves more slowly than in the East and therefore must have longer shelf life, acetate is the wrapper. In the East, spinach goes to market in perforated cellophane. And as in other vegetables, the variety of spinach grown in various parts of the country may determine the type of wrapper used. The same holds true of lettuce. The latter is the big prize that all film people are after; lettuce could use the biggest film volume of all, but no one has

yet found the right packaging material or the right variety of lettuce—or the right combination—to prevent spoilage.

Acetate film for produce packaging is now fairly comparable to most other packaging films in price. One and a half-mil polyethylene film is around 69¢ a lb. and will yield 20,000 sq. in. per lb.; 1.3-mil moistureproof cellophane is 56 to 62¢ per lb. and yields 14,000 sq. in. per lb.—the 0.9-mil material at the same pound price yields 21,000 sq. inches. One-mil acetate is 84¢ a lb., but yields 22,000 sq. in. per pound. The comparative prices then for 1.5-mil polyethylene, 1.3-mil moistureproof cellophane, and 1-mil acetate would be approximately 2.53¢, 3¢, and 4¢, respectively.

The over-3-gage film volume also benefitted last year from an increased demand for metallized film used mostly in packaging and for the usual applications such as displays, wallet inserts, menu covers, brochures, and price books. There was also a continuing demand for this heavier film by the Armed Services.

Vacuum Forming

Acetate producers are convinced that thicker sheet has exceptionally good possibilities in vacuum forming. It has the advantages of transparency, no dirt pick up, and is not likely to deform. Some promising developments in vacuum molded clear acetate signs were under way at the end of 1953.

Nitrate film and sheeting reversed its downtrend and indicated a fair increase for 1953. The increase came largely from the optical industry, but sheets for covering wooden and molded wood-waste toilet seats also came back in improved volume. Nitrate for pocket cutlery, piano keys, and drawing instruments remained about the same.

Cellulose acetate and cellulose acetate butyrate molding material increases were particularly gratifying to cellulosic producers because no one could say that the rise was due to a shortage in other thermoplastic materials.

Even If It Cost More

Everything molded from acetate or butyrate in 1953 was because the molder or customer wanted it that way, even if it cost more than some other material. There were no particularly new outlets developed, but some of the old ones returned—toys in particular. Several toy molders reported that they had come back almost entirely to acetate because of its more satisfactory toughness. Appliance housings, tool and hardware parts, sunglass frames, and special types of electrical fixtures, such as those for wire fences, held their own or increased their use of acetate and butyrate. Acetate for dolls showed a remarkable volume increase. About 1¼ million lb. of butyrate, acetate, and nitrate is estimated to have been used for fountain pens, a stable market for years.

The automotive industry re-

Estimated Consumption of Cellulose Plastics, 1953

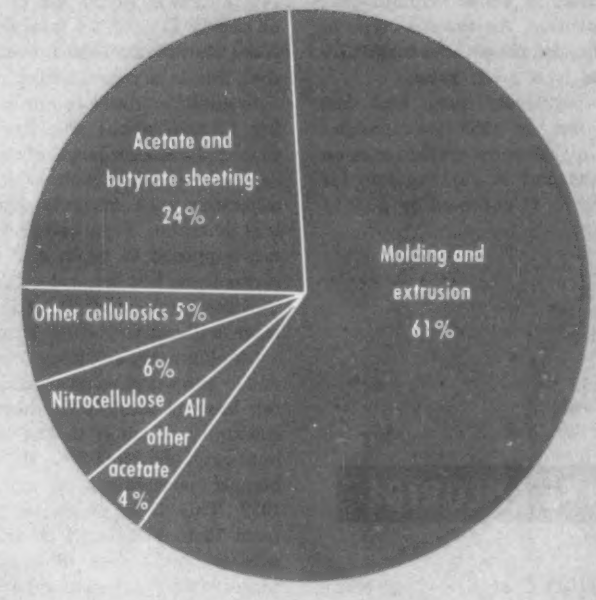


Table D—Cellulose Plastics Sales in Pounds[a, b]

	First 8 mo. 1953	*Estimated last 4 mo.*	*Total 1953*	*Total 1952*	*Total 1951*
Cellulose acetate and cellulose acetate butyrate sheets:					
under 0.003 gage	10,600,000	4,500,000	15,100,000	11,400,000	15,100,000
0.003 gage and over	8,700,000	4,300,000	13,000,000	9,800,000	10,400,000
All other sheets, rods, tubes	3,500,000	1,600,000	5,100,000	5,000,000	5,200,000
Molding and extrusion materials	50,300,000	23,000,000	73,300,000	58,600,000	62,200,000
TOTAL			106,500,000	84,800,000	92,900,000
Nitrocellulose: sheets, rods, tubes	4,500,000	2,000,000	6,500,000	5,500,000	7,400,000
Other cellulose plastics, primarily ethyl cellulose	4,600,000	1,800,000	6,400,000	6,500,000	10,700,000

[a] Source for 1951, 1952, and first eight months 1953: U. S. Tariff Commission; last four months 1953 estimated.
[b] Includes plasticizers, fillers, and extenders.

mained as the largest user of butyrate material for steering wheels, knobs, and arm rests. Telephone hand sets accounted for sizable quantities. Widespread use of butyrate for fish net floats and buoys has become so common that the market may decline because they never seem to wear out. Such an application would indicate that butyrate can be used in water without fear of deterioration. An unusual type of application to prove the material's toughness is a lawn rake.

A comparatively new and fast growing use in 1953 was molded butyrate markers for traffic lanes on city streets and in parking lots for

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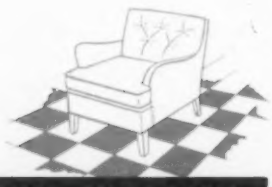


VINYL CHLORIDE

VERSATILITY of the vinyl chloride family has never been more forcefully demonstrated than in 1953. There was some feeling in 1952 that consumption of vinyl resin was beginning to show signs of leveling off, but any such fears were dissipated in 1953 when, despite a severe decline in production of vinyl film and a lesser decline in sheeting, there was a good rise in total production. Big increases in resin production for floor covering and fabric coatings, as well as modest increases in plastisols, garden hose, inflatables, and a few lesser markets, more than made up for the loss.

Floor Coverings

Most sensational advance was an approximately 100% increase in resin used for floor coverings. The vinyl industry has been waiting for this development to break loose for five or six years. Here is a good lesson in perseverance and faith. There was once considerable doubt as to whether or not the problems of shrinkage, adhesion, and cost could be overcome. The growth of the business from a 2- or 3-million pound consumption several years ago to well over 20 million lb. seems proof enough that the principal problems have been left behind. Producers now believe that floor coverings may be consuming between 60 and 75 million lb. of vinyl resin annually within five years' time. This would be 140 million or so sq. yd. of flooring, or nearly 21% of the total floor covering market. Present indications are that this is a conservative estimate.

In addition, there is another pleasing feature about this business in that it consumes large quantities of reprocessed vinyl resin which might otherwise seek markets where it is less desirable. Figures for scrap are not supposed to be in any of those given here, but several critics insist that the total couldn't possibly be so large without including scrap.

Linoleum-type floor covering, which is a vinyl sheet laminated to a felt base, is possibly the best known consumer of vinyl in the industry; but vinyl-asbestos tile showed the biggest percentage of increase in 1953. This latter material contains from 10 to 18% vinyl chloride, plus asbestos and other filler, and is a more rapidly growing type of high-grade floor covering which has become increasingly popular despite its high price. Six companies are already producing it on a large scale and more will follow. Fully resilient vinyl tile is also increasing in volume sales. There are two types—one is solid vinyl which is calendered and pressed; the other is a vinyl sheet laminated to a filled vinyl base.

Another type vinyl floor covering is a paper treated material coated with a plastisol and laminated to a felt base. The effort to use a plastisol or vinyl latex to replace enamel as a coating for felt base flooring is still in the developmental stage. Enamel coated felt is the lowest cost and largest volume floor covering on the market. If it ever goes over to vinyl coating, another big market would open up.

Extrusion and Molding

The largest use of vinyl chloride resin is for extrusion and molding material. It is also the most difficult category to divide into separate uses because there are so many unknown factors. Largest single use is in wire coating; it could have been between 50 and 60 million lb. in 1953, or about the same as 1952. There is a difference of opinion about how much this market may be expanded. The Armed Services have been using great quantities—as much as 400,000 to 1 million lb. a month for that purpose. Most house wire is already in vinyl. So where are the civilian outlets that will take up the slack when the full impact of military buying ceases? It would be an unusual accomplishment if vinyl wire coating expands much beyond present volume, but unusual things are expected from vinyl.

Garden hose is the next largest extrusion outlet. It grew from something like 12 million lb. of vinyl resin in 1952 to about 17 million lb. in 1953. Perhaps 3 million lb. of this is scrap material—and this is much too much according to some hose producers who insist that standards must be set up or their quality market will be harmed. In round figures, a total of about 300 million ft. of garden hose was produced in 1953. Nearly 200 million ft. of this was vinyl as against 160 million in 1952. There are 11 or 12 lb. of vinyl compound in 100 ft. of clear hose—about 13 in opaque—or an average of 7 lb. of resin, since the compound is 60% resin. These figures are rough and will get rougher as the industry becomes more competitive. More filler, more scrap, and smaller diameters are being used by those who try to compete at low price levels.

One interesting and significant development in the hose industry is that small, local extruders are still in business and doing well. A few years ago it was predicted that they would be forced out when all the big garden hose producers began production of vinyl hose. But the "little" fellow is still around and claims he can sell a 50-ft. unit to his local market at a dollar or two lower than the big fellow who has a much higher overhead. And some of the so-called "little" fellows have gone national, too. One can buy California-, Chicago-, or Jersey-made vinyl garden hose in many parts of the country from firms that were unknown in the garden hose field at the close of World War II.

Extruded gasketing for refrigerators, water coolers, and storm win-

dow channels is growing steadily. Extruded welting or beading for shoes, automobiles, and upholstery trim is increasing every year. Clothes line and elastomeric tubing are other extruded products. All these together probably use around 15 million lb. or more of resin over a yearly period.

Molded vinyl includes phonograph records; elastomeric parts, such as lawn mower handles, grommets, luggage corners; as well as molded plastisols.

Producers are unwilling to give production figures on any of these items, but it is difficult to perceive how the total for all these molded pieces can be much less than 25 million lb. for 1953. Vinyl for recordings may have declined during the year, but plastisol molding increased considerably. Around 5 million lb. was used for dolls alone.

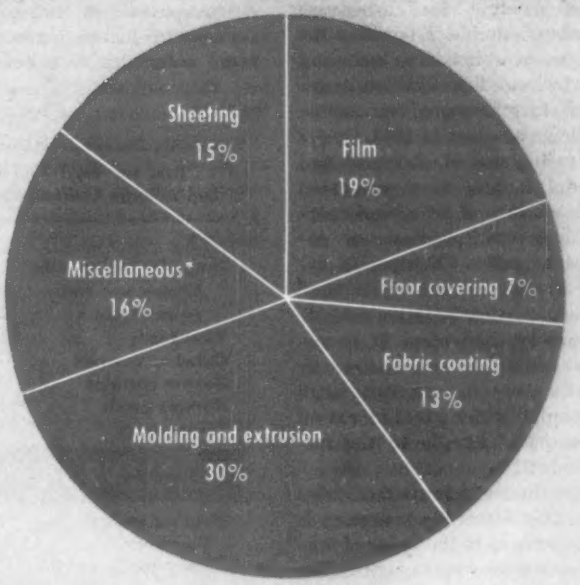
Rigid Vinyl

Rigid or non-plasticized vinyl molding may have reached a total of 3 million lb. during the year. Pipe probably used less than a million pounds. Sheet for ducting accounted for most of the balance. Rigid vinyl pipe and sheet is still an industrial baby in this country, although 3 or 4 million lb. of material are used annually for this purpose in Germany.

But a lot of spade work was done in 1953. Improved techniques and more adaptable resins are now in use. In addition, the price of high-impact rigid vinyl was reduced from 60 to 52 cents per pound. Extruders have also found that they can use almost the same resin for rigid extrusions that was heretofore thought usable only for elastomerics, provided that the impact requirement is not too high. They save on both cost and production time.

The use of vinyl pipe is being extended from chemical plants to the oil fields and water systems. The year 1954 should see a good increase along those lines. The use of rigid vinyl sheeting as a structural material for ducts, liners, sheathing, and signs is by no means fantastic as yet. Some day rigid vinyl may be the biggest volume use of all vinyls, but that is still in the future. Four or five years of disappointment and struggle elapsed before vinyl was widely accepted in floor coverings. It will take an even longer time before comparable volume can be ex-

Estimated Consumption of Vinyl Chloride and Copolymer, 1953



* Miscellaneous includes protective coatings, can coatings, sprays, sponge, ink, adhesives, paper treatment, coating for glass yarn, and items that can't be otherwise classified, and exports.

Table E—Vinyl Chloride and Copolymer Consumption in Pounds, 1951-1953

	1951		1952		1953	
	Resin	*Compound with filler*	*Resin*	*Compound with filler*	*Resin*	*Compound with filler*
Film under 10 mils	81,000,000	130,000,000	79,000,000	125,000,000	69,000,000	110,000,000
Sheeting over 10 mils[a]	67,000,000	121,000,000	74,000,000	148,000,000	54,000,000	102,000,000
Floor covering[a]	—	—	—	—	24,000,000	[d]
Fabric coating	35,000,000	80,000,000	38,000,000	86,000,000	48,000,000	100,000,000
Paper treatment	8,000,000	12,000,000	9,000,000	14,000,000	6,000,000	19,000,000
Molding, extrusion	90,000,000	164,000,000	105,000,000	200,000,000	110,000,000	200,000,000
Protective coatings[b]	—	—	—	—	20,000,000	25,000,000
All other[c]	42,000,000	56,000,000	35,000,000	58,000,000	30,000,000	50,000,000
TOTAL	323,000,000	563,000,000	340,000,000	631,000,000	361,000,000	606,000,000

[a] Resins used in floor covering were for the most part reported in sheeting in years before 1953.
[b] Protective coatings were reported in "miscellaneous" in years before 1953.
[c] In 1953 this figure is mostly exports, but there are a few miscellaneous catagories such as resin coated over glass yarn for screen cloth, some floor covering resins that cannot be reported as sheeting, and various other resins that cannot be classified under any of the items named above.
[d] Compound for floor covering not available.

pected in extruded and molded rigid vinyl.

Vinyl-coated fabric of both the calender-coated and spread-coated types increased around 35% in 1953 over 1952. It is believed that the division between spread and calender coating on fabric is now almost half and half, with calendered coating still holding a slight edge. It was a foregone conclusion several years ago that vinyl-coated fabric would eventually eat into part of the unsupported sheeting market because it has more suitable properties for many types of upholstery, including deep-spring and deep-cushion items.

Several factors were responsible for the unusual spurt in 1953. One is the increasing use of plastisols and organosols. It has been estimated that at least 70% of all spread coating is done with plastisols or so-called paste resins. Equipment for plastisol coating is less costly than for solvent coating because no solvent recovery equipment is necessary. In addition, either plastisols or organosols seem to add that extra little "oomph" which gives increased appearance and handle to the finished product.

Perhaps the most important point of all in this forward movement is the improvement in the types of textiles available for vinyl coating. The elastic or knitted cotton fabric backing permits upholsterers to handle the material with much more flexibility and satisfaction than straight sateens and twills. A new type of fabric for coating purposes is a continuous, twisted rayon filament which helps to eliminate "pick" spots. Rayon does not have particularly good wet strength, but the fabric side of a coated material is generally on the down or protected side, anyhow, and is protected from moisture by the vinyl coating. Another material beginning to gain more favor is unwoven cotton or rayon backing which has good flexibility and drape.

Glass fabric coated with plastisols and used for awnings has finally caught hold and seems to have met with customer approval. And there is always the possibility that strong, lightweight fabrics, such as nylon coated with plastisol, will eventually make a big dent in the high style market for rainwear, drapes, and many other applications. One experimental use of this kind now on test is a vinyl-coated nylon mail bag.

One of the most interesting of the newer developments in coated fabrics is that used originally in jackets designed for men's sportswear; it has now spread into the entire market with special emphasis on teen-age apparel and is even being used in auto robes. The fabric may be either a fluffy, woolly-type material or woven rayon and may be either paste- or calender-coated. Demand for jackets made of this material reached such a height in October that they were being shipped air freight to meet customer demand. When consulting figures on fabric coating in Table E, the reader should remember that the total includes a fairly good sized amount of vinyl latex that is used for coating fabric as a base coat before calendering with a coating resin. Another sizable amount of latex is also used by rug companies as a binder and to prevent fraying of the pad or bottom side of carpeting and rugs.

Uses for Vinyl Film and Approximate Consumption 1953

Uses	*Pounds*
Draperies, bedspreads, kitchen and bathroom curtains	26,000,000
Yard goods	10,000,000
Closet accessories	6,000,000
Shower curtains	6,000,000
Nursery goods	4,500,000
Table covers	4,000,000
Appliance covers	3,000,000
Chair covers	3,000,000
Wearing apparel	
Rainwear	12,000,000
Baby pants and bibs	3,000,000
Aprons	3,000,000
Miscellaneous	2,500,000
Industrial and military	6,000,000
Miscellaneous	8,000,000
Inflatables	15,000,000
	111,500,000

The figure on sheeting in Table E requires a lot of explaining. Sheeting did decline in volume by a few million pounds, but not as severely as film. The sheeting figure is 20 million lb. or so under 1952 largely because much of the resin used for floor covering was reported as sheeting in 1952, but in 1953 the figure for floor covering was reported separately. Another complicating factor is that the resin used for calendered rigid vinyl sheeting and planished sheet for patent vinyl, as well as much of the resin used for inflatables is also reported in this overall sheeting classification, and producers are loathe to report the exact volumes sent to each market. It should also be noted again that vinyl-coated fabric cut into the unsupported vinyl sheeting market.

Vinyl sheeting for upholstery, luggage, and novelties moved in surprisingly large volume during the first four or five months in 1952 but declined when the furniture market slumped in the last half of the year. Light or 12-gage material, used primarily for upholstery without deep springs or thick padding, was the predominant item in the sheeting field. The heavier gages seem to have suffered most from the invasion of coated fabric into the upholstery field.

Vinyl Over Wood

One of the growing uses for sheeting is a press-polished sheet for upholstering wooden hampers. It is an 8-gage skived printed sheet to which is laminated a 4-gage sheet of clear film. Other types of vinyl sheet are also used for covering hampers, and that market is now consuming vast quantities of vinyl. This use of vinyl over wood is also spreading to such things as mantels, corner cupboards, bedroom screens, or almost anything in the home where a wood base is used.

As a wall covering, vinyl has as yet hardly made a dent in the market, but again, like the example of floor covering, it may suddenly burst forth in large volume.

At the moment, vinyl sheeting producers are a bit unhappy at the slowness with which expanded markets are developing, but they are hopeful that there will be no further decline in 1954 and recognize that their selling and promotion efforts must be stepped up in order to move more material in fields where vinyl is already established and find new fields where it can be used.

Probably the most unhappy people in the vinyl industry last year were the film producers. Resin consumption for film dropped from 80 or 85 million lb. in 1950, the best year in the industry, to under 70 million lb. in 1953. No one knows the exact amount of film produced from that resin, but one important producer says that volume of finished film has dropped from 150 million lb. or more in 1950 to around 100 million lb. in 1953.

The film business is believed to have dropped somewhere between 15 and 20% in 1953 compared to 1952; some operators were hit even worse than that. The pain was especially acute because their capital investment was so high and frequently there has not been enough time since calenders were installed to pay out on the investment. Two or three film producers went out of business and there are no reports that anyone operated at capacity during the year. The industry's capacity to produce film is so much greater than its present market that this fundamental problem may remain critical for some years to come. The price structure is chaotic. Critics state that film may be obtained at prices ranging from 50 to 67¢ a lb., yet the compound from which film is produced is in the 40-cent range. That doesn't leave much margin for profit.

Chances are that this unhappy situation in the film business may be the gimmick by which the industry pulls itself together and goes forward to even greater levels than in the past. Business was just too good in 1950 and part of 1951. All kinds of evils, including poor quality and poor merchandising, developed in that period because it seemed that there was a market for anything. But now the producers know that they must make adjustments to meet a changed condition. One of the first steps has been adoption of Commercial Standards. Some critics claim that the Standards' requirements are not high enough to keep poor quality material off the market, but at least the move is a step forward.

The vinyl film industry can deliver quality goods if it tries—the problem is to make it 100% quality. The "bargain-basement" stain is not easy to remove, but at least one producer is going to try hard to do something about it in 1954 by initiating a huge advertising campaign to be released on a national scale in a number of the better-known consumer magazines.

Biggest Film Outlets

The chief film product affected by the volume decline has been drapes. Bathroom and kitchen drapes are still among the biggest outlets for film, but drapes for other parts of the house have either saturated the possible market or met resistance by the housewife. Possible expansion in this field is in the lap of Mrs. America. At the present moment she has cut back her purchase of vinyl drapes. Perhaps she is merely appraising the situation or trying to make up her mind whether or not she likes the product. One observer

(*Continued on p. 162*)

MORE acrylic material was used by the civilian economy in 1953 than in any previous year. Both sheet and molding material moved upward even though one of the two cast-sheet producers ceased operations. The reason given for the latter move was an uneconomic operation in an obsolete plant. The remaining producer probably has more capacity now for cast sheet than both producers had together at the end of World War II, and capacity then was far above civilian demand since plants had been built to take care of the abnormal requirements for airplanes. At present no one sees a possible shortage in acrylic sheet supply in the near future. If war should intervene, new facilities for cast sheet would presumably be needed, but they could probably be erected just as fast as new airplane facilities could be built to take their output. New acrylic monomer facilities have been built or are being built so that no shortage of that basic need is anticipated.

Some industry observers felt that a possible increased output of extruded acrylic sheet was the hidden factor in the reason for one company's retirement from its cast sheet operation, but there is little evidence that much extruded sheet is on the market.

The technique of producing an extruded sheet with clarity equal to that of cast sheet has not yet been perfected, and, furthermore, the price differential does not offer enough advantage to extruded sheet. Fabricators say that when they can save 20% on the purchase of extruded sheet over cast sheet, they will adopt it for some uses.

One-quarter-in. cast sheet at $1 a lb. and ⅛-in. cast sheet at $1.30 a lb. are prices that extruded sheet made from 70¢-a-lb. molding material would have trouble in meeting.

However, 0.060-in. extruded sheet at $1.20 a lb. will probably attract business in applications where the use of 0.060 has been limited.

Extruders generally are interested in long production runs in a single width and thickness. Therefore, even though extruded sheet is good for a number of applications such as glazing and point-of-purchase signs, it has not gained widespread use because the individual orders for these applications are generally small. Extruded light fixtures of both the flat and trough type are practical when in sufficient quantity, but only a few commercial installations have thus far been made.

Extruded sheet is also limited in width—generally to 37 inches. Technicians claim that 57-in. material is feasible, but there is little, if any, on the market. On the other hand, cast sheet in gages up to ⅛ in. is produced up to 72 in. in width.

Another marketing move that created considerable talk among fabricators was the sheet producer's announcement that he would accept no orders for less than 500 square feet. The move was made to facilitate deliveries of small quantities at the local level from increased dealer stores. As a result, the small user of sheet should find it more convenient to deal with the local distributor than with a single large supplier,

Sales of Principal Plastics Materials by Months for 1951, 1952, and

	JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53
Acetate film	2.7	1.8	2.0	2.0	1.5	2.1	2.3	1.4	2.7	2.5	1.7	2.4	2.4	1.5	2.6
Acetate and butyrate molding material	6.3	3.9	6.2	5.7	4.0	5.9	6.1	4.3	7.0	6.0	5.0	6.9	5.9	4.2	6.2
Phenolic laminate	7.5	5.2	7.1	6.2	5.1	6.2	8.0	6.0	7.0	7.3	5.5	7.0	7.5	4.8	6.6
Phenolic molding material	19.3	13.8	19.3	15.9	11.3	17.0	18.8	11.2	21.0	17.6	12.3	21.0	18.9	10.4	18.4
Styrene molding material	18.4	15.1	24.4	17.1	15.9	26.5	20.2	17.7	28.2	20.8	18.7	29.6	20.5	16.3	25.7
Vinyl film and sheet-resin only	15.5	13.1	14.8	12.9	12.7	16.3	15.4	14.0	17.6	13.9	12.5	16.6	13.8	12.0	14.8
Vinyl molding and extrusion-resin only	11.1	11.8	15.4	9.9	11.2	13.9	11.5	12.8	14.9	12.2	12.0	15.3	12.7	9.3	13.5

and local dealers are becoming essential, especially to fill the needs of local sign makers.

Signs are still the largest civilian outlet for acrylic sheet; they consume about 50% of all sheet production. Injection molded signs which looked promising a year or two ago have not made much headway; injection molding problems on signs as large as 12 in. wide and 4 ft. long are difficult to overcome.

Other uses for sheet continue to include bath tub enclosures; lighting fixtures; display lids on grocers' freezers; juke boxes; popcorn machines; fruit juice dispensers; and fluorescent street light globes. Most of these show only normal growth—nothing sensational. Some, like the popcorn machine enclosure, seem to have saturated the market in a couple of years. Glazing for industrial and school buildings is a practical application where window breakage is a problem.

Two new automotive uses for sheeting in 1954 were the side windows in Corvette sports cars and the front half of the hard top cover on two other automobiles.

New Formulations

Two new sheet materials, Polymer X and Plexiglas 55, received considerable attention in the press in 1953. The producer, Rohm & Haas, states that these materials have no particular significance for the civilian market. They were developed especially for airplanes to overcome crazing problems at ultra-high altitudes and in pressurized cabins. The price would be considerably more than standard acrylic sheet.

Acrylic molding powder volume continues to increase each year. Much of the growth is the result of more widespread use of molded acrylic medallions and lenses for automobiles. Metallization of the plastic has helped their already high decorative appeal. Size per unit, as well as number of pieces, is increasing each year. Industrial designers are currently working with acrylic for decorative inserts on handles and facings of household appliances such as refrigerators, air conditioners, and radio and television sets. They picked up this idea from the automotive industry, and the acrylic industry is hopeful that it will turn out to be just as fruitful.

Acrylic for brush backs always has been the steadiest and most reliable of all the various outlets. Competition threatened from other thermoplastics for a while, but acrylic's beauty is a difficult property for any other material to match. And where beauty is a strong selling factor, acrylic is always going to be a material which it will be mighty hard to replace.

MOLDED nylon items are playing an increasingly large part in the life of at least two dozen molders, and many others are working with nylon in the expectation that it will eventually become a more important part of their business.

Du Pont, the producer, will give no hint of annual volume. Various molders estimate that sales of nylon molding powder are at present in the neighborhood of 12 million lb. annually.

Rapid expansion is not expected because cost of the material is $1.60 a pound; many molders hesitate to investigate its possibilities for fear they will be required to adopt special techniques; exhaustive sales and engineering programs are required to find large-scale outlets for molded pieces.

Yet only a few years ago less than a million pounds a year went into moldings. Considering cost, temporary scarcity during the Korean war, and the problems involved in interesting the molder, its growth is a high compliment to the natural capabilities of a remarkable plastics material. One third of production is believed to go into molded products and two thirds into wire coatings, surface coatings, and adhesives. A couple of years ago at least 60% was estimated to be for use by the military alone.

There are presently six better known types of nylon molding powders which vary slightly in their properties and in suitability for various applications. The best known is FM-10001 which is widely used for general-purpose moldings. It is highly fluid at molding temperature and suitable for gears, cams, bearings, washers, valve seats, brushes, and combs. Other types vary in properties—one has less moisture absorption; another is soluble in alcohol but resists gasoline and oil;

1953, in Millions of Pounds

The traditional trend of month-to-month sales was reversed in 1953; first half of year was larger than last half

JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53	'51	'52	'53
2.5	1.4	2.9	2.6	1.6	2.1	2.2	1.8	2.4	2.0	1.9	2.4	1.7	2.6	2.6	1.2	2.1	1.9	1.2	2.1	1.9
6.1	3.9	6.4	5.7	4.5	5.5	5.1	4.8	6.3	4.5	6.0	6.0	4.5	6.6	6.5	3.5	5.9	6.5	3.5	5.3	5.0
6.4	5.2	6.5	5.3	4.6	5.0	5.9	5.0	5.8	5.3	6.4	7.6	6.0	7.5	7.2	5.3	7.0	6.0	4.9	6.6	5.0
18.3	9.4	19.0	15.9	8.3	13.9	15.8	13.2	15.3	16.4	14.8	17.0	20.1	18.4	18.0	16.1	17.5	16.0	12.6	17.8	14.0
21.5	16.5	22.9	23.7	16.4	21.8	24.1	20.5	22.5	23.0	24.1	23.0	23.3	33.3	22.0	19.5	31.3	25.0	14.3	27.3	19.0
14.2	10.0	14.7	14.0	10.5	8.9	12.5	13.3	11.5	11.5	14.0	n.a.*	13.9	16.3	n.a.*	12.5	13.7	n.a.*	11.0	12.9	n.a.*
13.4	8.7	13.4	11.5	8.3	8.6	11.9	11.5	8.7	10.6	12.7	n.a.*	10.3	14.0	n.a.*	10.5	14.0	n.a.*	9.4	14.8	n.a.*

*Estimate not available but believed to be much better than summer months, although not as good as spring months.

one with unusual impact resistance is suitable for soft hammer heads; still another is flexible as leather and used for valve seats, impact pads, wrist watch straps, and textile coating.

Versatile Material

This versatility is an important factor in accounting for nylon's past and present growth. From an egg beater bearing to a snap-on shirt button to an auto speedometer gear to a 2-lb. piece on a textile loom is just a tiny sampling of its utility. As a wire coating it may extend the life of steel, copper, and aluminum wire from four to 10 times. Probably every refrigerator made today has a door latch with a nylon roller that is tougher and cheaper than its metal equivalent.

Nearly all automobiles are using nylon for speedometer drive gears. Nylon parts for door locks are now used on Fords and Mercurys.

Hospital supplies with nylon molded parts have the advantage of being susceptible to sterilization.

Model locomotives, once made entirely of metal, now have moving parts made of nylon because of low coefficient of friction in contact with metal.

Experimental nylon gears have been running under water for a two-year period and are still as good as new.

Nylon bearings are probably the best known of all its uses, but they should be used primarily for high-speed, low-load applications or high loads at low speeds.

As a metal replacement, nylon parts are generally less costly than metal parts. In one model train component for example, nylon cost is ½¢ in contrast to 12¢ for metal. It is believed that nylon can be used in almost any application where brass is now commonly used. One example is sash locks for windows. In the million or so homes built in 1953, with an average of 15 windows each, there could have been a big market for nylon locks. Each lock would have contained 15 g. of nylon. Brass locks cost 12¢ each and have a weight of 94 grams.

If sufficient nylon locks had been sold, they would have cost only 10.1¢ each. And a nylon lock is strong enough so that if the window is forced, the holding screws will tear loose and the lock will remain unbroken.

Cost Reduction

In many cases where nylon replaces metal, it can reduce the cost of production by 50 to 75% and provide durability equal to and better than the metal part replaced. It is in this field where nylon prospects look brightest.

The average molder has been expanding his sales of nylon parts at a rate of 25 to 50% for the last four years, but since all started from a low base, the quantities consumed are still relatively small.

At the present moment, few molders will predict a rapid expansion, but most of them are content to accept a gradual increase. They say that if the price were ever to decline to $1.25 a lb. from its present $1.60, the volume increase would be a greater ratio than the percentage of price reduction. One molder even thinks it could then be used in automobile engine parts because it will resist temperatures ranging up to 300° F.

Other possibilities for the future are more refrigerator and business machine parts, desk drawer rollers, furniture casters, as well as postage meters and similar instruments.

CARRYING on from its magnificent spurt in the last four months of 1952, the polystyrene molding material market continued at an encouraging rate for the first four months of 1953—but the pace was too fast and couldn't be maintained for the rest of the year. Even that 300 million estimate for 1953 (see Table F) may have a few million pounds of wishful thinking included in it.

Untrammeled by raw material shortages and with a clear path ahead, the industry had hoped for a 30-million lb. monthly average or perhaps a 350-million lb. year. In the last three months of 1952, record amounts of 33, 31, and 27 million lb. respectively were consumed, and it seemed that the trend would continue. In November and December

Estimated Styrene Resin Consumption in 1953, by End Products

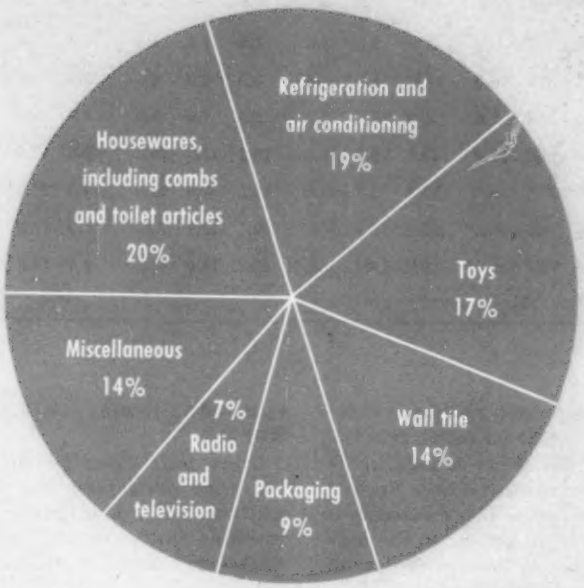


Table F—Styrene Resin Sales in Pounds[a]

	First 8 mo. 1953	*Estimated last 4 mo.*	*Total 1953*	*Total 1952*	*Total 1951*
Molding-materials[b]	201,000,000	89,000,000	300,000,000	248,579,000	245,000,000
Protective-coating resins[c] (straight and modified)	55,500,000	33,000,000	88,500,000	66,500,000	48,000,000
Resins for all other uses[d]	50,000,000	25,000,000	75,000,000	76,891,000	63,083,000
TOTAL			463,500,000	391,970,000	356,083,000

[a] Source for 1951, 1952, and first eight months 1953: U. S. Tariff Commission; last four months 1953 estimated.
[b] Includes plasticizers, fillers, and extenders; also modified and copolymer molding materials.
[c] Includes high styrene-butadiene resin for latex; also resin for styrenated alkyds.
[d] Includes high styrene-butadiene rubber reinforcing resins; polyesters based on styrene; ion exchange resins; metal treating resins; and miscellaneous.

of 1952, commitments were made that would have sold out the industry through March; polymer was even brought in from Canada. But sales went down to 25 million in May 1953 and probably didn't go much over that even in the ordinarily high volume months late in the year.

Most businesses would be well satisfied with the 20% gain which the industry attained. If that kind of an increase can be maintained over several years, there will be little to fear for the future. An interesting angle is that the industry is still expanding its polymerization facilities, even though proved capacity is already over 400 million pounds.

There are several present trends in the industry which could help to keep volume on an upward curve. One is the expected shift to a greater amount of high-impact polystyrene. One producer estimates that high-impact material volume was between 80 and 90 million lb. in 1953 or twice as much as in 1952. He predicts it will reach 150 million in 1954 and will also continue to improve in quality until it will reach a toughness comparable to ethyl cellulose by 1955. After that year the majority of polystyrene produced will probably be high-impact. A recent price reduction, which makes high-impact only 1½¢ higher than standard material, is highly significant.

The so-called copolymers, which are usually styrene and acrylonitrile with some other modifications, will probably remain in rather small volume, in contrast to high-impact polystyrene, unless someone finds out how to make them less costly. Some copolymers are making an impression in the pipe field. This could run into big volume later on, but right now it is too new for proper evaluation. Fair amounts are already being used in fittings for polyethylene pipe.

Still another variation along this line is a new styrene copolymer resin which contains no rubber but has extremely high-impact strength and can be injection molded. Presently it is being diverted to the sheeting market, but injection molders are interested; it can also be modified with whiting or graphite to make tough extruded pipe.

Increasing use is being made of high-impact polystyrene and a polystyrene-rubber copolymer sheeting material, especially adaptable to vacuum forming, in signs and paneling of all sorts. Low cost makes it competitive with any other plastic used for these purposes.

Vacuum forming is still an infant in the plastics industry and equipment manufacturers are striving to improve machines and make the process more simple. With such improvements, this form of plastics processing may reach a volume only dreamed of as yet. There is still a widely held belief that a vacuum former hooked onto an extruder can be made to perform with a speed and perfection that can surpass almost any other form of operation known to the industry today.

Housewares and refrigerator parts are still the largest volume molded polystyrene products. There are still some complaints about unfit applications and about attempts to chisel on price by using thin walls, but a visit to any housewares show will quickly prove that polystyrene products have been upgraded in the past two or three years. There will undoubtedly be competition from other resins as time goes on, but polystyrene should remain a strong factor in this field for a long time to come. Color and price alone are properties hard for the competition to match. Supermarkets are aiding in the distribution of housewares and no doubt adding to total sales.

Refrigerator parts vie with housewares for the lead in use of molded styrene; the two alternate for the lead during various months. Shipments of refrigerators amounted to 2,700,000 units in the first eight months of 1953, or 367,000 more than in the similar period of 1952. And that is in a saturated market. The refrigeration tooling program in late 1953 looked good for plastics. High-impact material was used primarily in the refrigerator industry. But supplying the resin to this specialized field has been a headache to some producers. Rejects are high because one speck of dirt in a 30-by 60-in. door liner will throw it out. Pastel colors wanted for the job are difficult to make.

Air conditioner parts are included in the refrigerator field. Louvers, outside housings, and inside shells, are being molded from styrene. Here is a most lucrative market. Fewer than 1% of the more than 40 million homes in the United States had air conditioners at the beginning of 1953. It was expected that over 600,000 units would be sold during the year. Styrene was used in only a small portion, but the market is big and hopes are high.

Toys and Wall Tile

Polystyrene toys consumed large quantities of molding material in 1953, but the field is one about which the industry is none too happy. A big portion was in the less-than-a-dollar toys and many products brought down considerable criticism on the industry. High-impact for future toys may be the answer, but unless that corrects the situation, there may be a decline in styrene resin used for this purpose.

Sales of wall tile continue to grow. Probably 40 or 45 million lb. of styrene were used for this purpose in 1953. One company obtained an $800,000 contract for a New York City job. Ten thousand square feet were installed on another job on a high school stairwall because the tile is easy to keep clean and immaculate. Sears, Roebuck will reportedly use 7 million lb. of resin for 14 million sq. ft. of tile to supply their needs.

Improved tile quality and mastic that sticks without showing through are two of the reasons for increased popularity of styrene tile. One company, at least, is annealing its product with dry heat and making thicker walls to improve its product. Larger sizes, such as 8½-in. square panels that give the effect of Carrara glass, are also being used; even larger sizes—as long as 20 in.—are contemplated. Polystyrene wall tile has come a long way since its introduction five or six years ago.

Radio, Television, Music

In the radio and television field, high-impact material for television masks is still predominant. Styrene has also taken over 60 to 70% of the portable and clock type radio cabinets.

Polystyrene phonograph records is another growing application—much larger than believed in some circles, but the chief producer of resin for this purpose won't talk. When asked for details, he looks like the cat that swallowed a canary. As usual, the record industry pretends to be confused and gives conflicting answers on polystyrene's performance. But the best informed opinions certainly confirm the idea that styrene has a potentially big stake in the field.

Latices

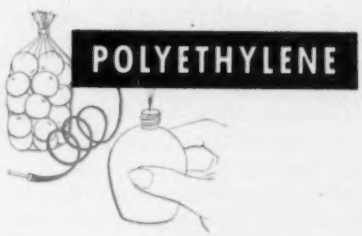
Styrene latices continue to show almost phenomenal growth. There are several types on the market using styrene monomer and polymer, as well as butadiene. The monomer-butadiene type, using about 70% resin, is primarily for "water" paint and styrenated alkyds. In the beginning this was primarily an indoor paint, but several formulations have been developed for outdoor use. The latter have high alkali and good age resistance and are recommended for stucco.

Styrene paint latex has grown from 2 million gal. in 1949 to over 45 million in 1953, or about 15% of the national production for paint, varnish, and lacquer. Each gallon requires about 1½ lb. of resin.

There are also several formulations being used for paper coating with about 50% styrene and 50% butadiene content, although two of them at least are straight polystyrene latex that require plasticization. There is also a 60-40 styrene-butadiene latex on the market which is used for clay coating on paper and is considered to be using many millions of pounds of styrene monomer, but it cannot be accounted for in the Tariff Commission's figures.

The miscellaneous figure in Table F is difficult to interpret. It includes high-styrene-butadiene which has an 85-15 proportion of monomers. It is used for shoe soles and rubber floor coverings. The shoe soles have taken over more than 50% of the market, and a new method of making the soles by blowing requires much less resin. Rubber flooring is having trouble meeting competition from vinyl, so that market may also be off a bit. This over-all miscellaneous figure is also supposed to include polyester resins with a 30 or 35% styrene base.

(*Continued on p. 165*)



POLYETHYLENE production was estimated at about 135 million lb. in 1953, divided about as shown in the chart on page 80. The total was an increase of about 30 million lb. over 1952, but was still not enough to satisfy demands.

Toward the close of the year, the first of Bakelite's three new plants, with a capacity of 60 million lb. a year, came on stream; until that time polyethylene was scarce during each month. In September, Du Pont changed over completely from the old Alathon I and II to Alathon 10, which is a higher molecular weight material than the older products, and is reportedly upgraded in every respect. Bakelite reduced prices twice during the year; its base price is now 41¢ a pound. Du Pont reduced their price from 49 to 46 cents. Howard Bunn, vice president of Union Carbide, stated last summer that he could foresee a price in the 30-cent range before long—even a possible 20-cent range in the not too distant future.

Rate of production should now be in the neighborhood of 15 or 16 mil-

lion lb. a month when all present plants are running at capacity. When the new Du Pont plant and the new Bakelite plant at Seadrift, Texas, come in next summer, the rate should approach 24 or 25 million lb. a month. By the end of 1955, the rate may be 45 million lb. a month—more if all companies that have announced their plans come into production. If that should come to pass, polyethylene would then probably be the largest volume plastics in use based on a solid resin content, although plant capacity might not be quite as great as vinyl chloride, phenolics, or styrene resins. The conjecture is based, of course, on the belief that demand will keep up with supply, although such thinking must also be tempered by the possibility that not all of the proposed plants are likely to be operating at capacity by the end of 1955. The history of polyethylene indicates that new plants almost never come in on schedule anticipated.

It is expected that the new Bakelite plant at Texas City, with a 5-million lb. a month production in December 1953, plus a smoothly operating Du Pont plant that should have ironed out all its bugs from the change-over by that time, will take care of the demand for polyethylene for the first two or three months of 1954, except that January may be tight when inventories are built up.

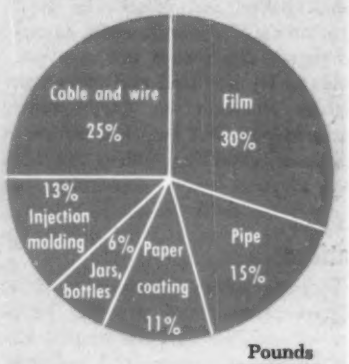
Increasing Demands

For two or three months after January, supply may possibly be greater than demand, but only until users get their equipment ready to handle more material and their sales organizations geared up to sell more goods. It is likely that the spring and early summer months of 1954 will again find polyethylene in short supply because of increasing demand by polyethylene users when they find it available. However, it is probable that the new Du Pont plant at Orange, Texas, and the second new Bakelite plant at Seadrift, will come on stream some time before September 1954. Shortly after that, a flock of new plants are scheduled to begin production.

It hardly seems likely that polyethylene should ever be scarce again after September 1954, unless emergencies should intervene. All present uses are expected to expand and many new ones will be found, but there is a limit to the speed at which they can grow; producers will soon be in a position where they can keep up with almost any new demand. An all-out war would probably raise havoc with civilian uses, for the Armed Services would certainly demand unbelievable amounts of polyethylene. But currently, the Government is using less than one-fifth of all the polyethylene available.

The additional plants which owners hope will come in during 1954 or 1955 are: Texas-Eastman, late 1954, 20 to 30 million lb.; Spencer Chemical, late 1954, about 50 million lb.; Monsanto Chemical, late 1954, 66 million lb.; Dow Chemical, late 1954, no volume announced; National Distillers, mid-1955, 25 million lb.; a third new Bakelite plant in California, mid-1955, 60 million pounds. In addition, Allied Chemical has announced its intention to build a plant soon. And there is always the possibility that Du Pont will build new capacity soon in addition to the new plant they expect to have operating by mid-1954.

Estimated Polyethylene Consumption in 1953, by End Products



	Pounds
Cable and wire	34,500,000
Film	39,000,000
Pipe	20,000,000
Paper coating	15,000,000
Bottles and jars	8,500,000
Injection molding	18,000,000
TOTAL	135,000,000

Practically all the above companies are also making plans to expand their presently announced capacity in due time. Even Bakelite, which has announced a planned total of 250-million lb. capacity by mid-1955, states that it will expand beyond that if the market continues to increase. And there are several other companies that have not made their plans public but which seem to be quite sure of eventual entry into the field unless the prospective market shows signs of declining.

On the other hand, one prospective producer, the Firestone-Cities Service combination, has apparently declined the issue. It also seems strange that several petroleum companies, which a few years ago were the chief prospects for entering the business, have made no public move to indicate their intentions. It may be that some companies are unwilling to disclose their plans until after the I.C.I. patent expires in 1956.

There is also activity in foreign fields. C.I.L. in Canada will open a 12-million lb. capacity plant in early 1954. They expect to expand soon. Imperial Chemical Industries in England, the original producer, reportedly has a six-million lb. plant in operation and is thought to be planning a 100% expansion. But it is believed that polyethylene in most foreign countries will always be higher in cost than in North America because costs of petroleum, from which the ethylene is derived, are greater.

In England today, polyethylene is 50¢ a lb.; consequently, the British are striving to make vinyl do some of the jobs where polyethylene might be used in the United States. Furthermore, there is very little refrigeration in England, so there is no market comparable to that in the United States where polyethylene is widely used for refrigeration packaging and storage. In Australia, where the refrigeration market is good and could be a vast potential for polyethylene, the material costs 70¢ a pound.

Vegetable Bags

Polyethylene film may always continue as the leading outlet in the field, no matter how great the total. Potentialities are almost unbelievable. Two beauties came into bloom during 1953. One grocery chain used 50 million polyethylene bags for carrots.

(*Continued on p. 167*)

Significant Applications: 1953

IN THE early months of 1953, the plastics industry was faced with a fundamental need for broadening the bases of plastics applications (1)[1].

The preceding year, 1952, had witnessed a sound expansion in most of the existing markets for plastics but, in general, it was an expansion along conventional lines. The availability of more and better plastics materials in 1953, however, coupled with advances in processing techniques, called for a new attitude on the part of the plastics industry . . . for new thinking about new markets.

The industry met the challenge with marked success.

Advances in plastics applications in 1953 are going to have an important bearing on the future of the plastics industry. Already, the year's activities have stimulated more industrial designers and engineers to a new consideration of plastics materials. Industries that have never before used plastics are now definitely planning to use them or are carefully considering their possible use.

Concept of Design

The dominant theme behind this progress in plastics applications in 1953 was the revised thinking on the part of industrial designers as regards the use of plastics materials (2). Many of the products which made their debut in 1953 were designed specifically to take advantage of the properties of plastics. In contrast to engineering and design thinking in the past, plastics were chosen for these applications not as replacements for metals, ceramics, or other non-plastics materials, but as basic materials with outstanding properties of their own.

To the industrial designer, the success of the new "design for plastics," as evidenced, for example, in the attractive, functional portable refrigerator introduced in 1952 (3), was the handwriting on the wall, the prophet of doom, for the

[1] Numbers in parentheses link to MODERN PLASTICS references starting on p. 175.

Courtesy Warren Furniture Mfg. Co.

Lightweight yet rugged one-piece molded phenolic furniture drawer operates smoothly regardless of temperature or moisture conditions

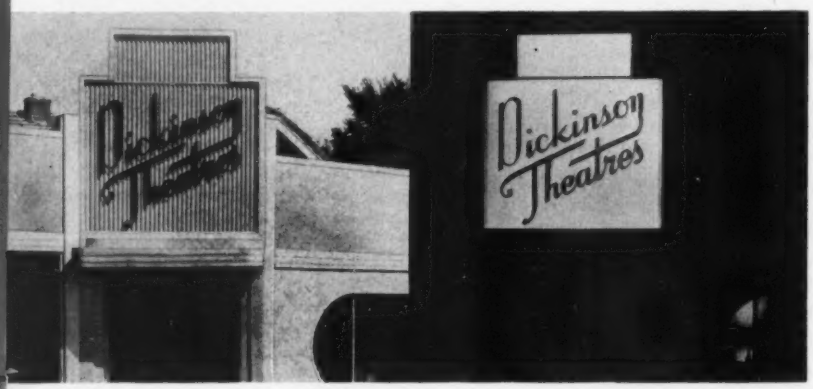
Space-conscious younger generation gave impetus to the development of such interplanetary gear as this acetate helmet with vinyl jet tanks

Courtesy Eastman Chemical Products, Inc.

Safety hat is injection molded in one piece of modified styrene copolymer, has neither joints nor seams to weaken it

Courtesy Pacific Plastics Co.

Glass cloth is applied to boat hull coated with polyester resin



Corrugated acrylic sign is effective for day- as well as night-time display

Courtesy Rohm & Haas Co.

Knife blades are permanently mounted in cellulose acetate butyrate handles

Courtesy Eastman Chemical Products, Inc.

old-fashioned "switch-to-plastics" school of thought. Since that time, the new "thinking" has produced, among others, three outstanding products which exemplify this concept of design. These are:

1) A 24-lb. photo copier designed to reproduce letters and documents in less than a minute (4). The more than 12.7 lb. of plastics that are used in this unit include modified styrene, nylon, polyethylene, butyrate, alkyd, and phenolic parts.

2) A moisture condenser which dehumidifies air in summer and humidifies it in winter (5). With the exception of the mechanism and the metal frame, the unit consists almost entirely of molded styrene and styrene copolymer parts.

3) A portable phonograph incorporating a molded styrene case, motor board, and carrying handle (6).

In all three of these examples, the production of similar coordinated units at the same price and with the same properties, would have been virtually impossible without the use of plastics.

Military

The applications described above, while of extreme importance to the plastics industry as forerunners to broader applications of the new concept of design, are but a small fraction of the new products and adaptations of old products reported in MODERN PLASTICS in 1953.

In military applications, for example, plastics had a busy year. While not as much money was being spent for defense purposes in 1953, the Armed Forces remained an important market for plastics.

In the aircraft industry, in particular, plastics put its best foot forward. Since the introduction of jet engines, rocket propulsion, and guided missiles for the Armed Forces, progress in the use of plastics has been almost fantastic. As reported in the series of articles in MODERN PLASTICS (7), plastics for large structural components as well as for small minor components were supplying the much-needed answers to the ever-increasing demands in military aircraft and missile performance.

Several of the techniques and materials developed in the course of the aircraft expansion program proved of interest to the manufacturers of civilian products. For example, two foamed plastics based on isocyanate resins (8), originally formulated to serve as lightweight insulation for aircraft parts, have proved equally as adaptable for such civilian applications as packaging, flotation, ear muffs, etc.

The plastic body armor which made such an auspicious debut in 1952, was perfected even further in 1953. Two improved versions of plastic body armor were supplied to the Armed Forces during the closing months of the Korean war (9). One, a new model of the Marine Corps armor vest, consisted of pieces of polyester-glass laminate with a nylon duck covering; the other was a new version of an Army vest which uses layers of nylon duck covering bonded with synthetic resins to reduce penetration.

Industrial

The use of plastics in industry in 1953 was characterized chiefly by the large scale expansion of appli-

cations first introduced only a few years ago. Plastics pipe, tubing, and fittings, for example, had developed by 1953 into one of the major weapons in industry's battle against the ravages of corrosion (10).

Fibrous glass-reinforced plastics tanks, for another, continued their impressive invasion of a diversified range of industries. A big hit in 1952—and a source of much speculation—the plastics tanks in 1953 justified early predictions as to their success (11). Throughout the year, plastics tanks were being installed in oil fields, chemical plants, on fuel-carrying trucks, etc. In the closing months of 1953, the introduction of two experimental models opened even bigger possibilities for the application. One was a 3400-gal. chemical transport tank (12) and the other, a 4000-gal. milk truck.

offers many opportunities for the material as valves and meter parts, safety shields, fire extinguisher nozzles, in various electrical uses, and as funnels and floats (16).

In an always-popular field for plastics applications—industrial safety equipment—safety hats molded of styrene copolymer (17) and protective coveralls woven of vinyl chloride-acrylonitrile threads (18) were introduced.

Other industrial applications, either made possible because of the use of plastics or improved considerably by the introduction of plastics parts, included a resilient vinyl core for a steel cable to be used in oil well drilling (19); storage batteries made of plastics and incorporating plastics parts (20); plastic laminate bobbins for use in the production of nylon yarns (21, 22); and

Courtesy U.S. Rubber Co.
Outdoor display, 6 ft. high, is molded of rein-impregnated fibrous glass

Reinforced plastics storage tank for crude oil is corrosion resistant
Courtesy Murdock Tank and Mfg. Co.

Styrene housing for adding machine contributes to beauty and portability
Courtesy Clary Corp.

In a similar vein, pressure-sensitive tapes that use plastics as a backing or as a coating came into their own during the year (13, 14). Applications for pressure-sensitive tape include anti-corrosion pipe wrappings, cable wrappings, waterproof sealing, packaging, identification tapes, splicing, and insulation.

In other phases of industrial life, activity in the development of plastics applications was also impressive.

Reinforced plastics tools began to appear in the automotive, aircraft, appliance, and similar industries (15). The success of these tools in reducing costs and simplifying general tooling operations has aroused a great deal of comment on the part of engineers and designers.

Polyethylene, as well, absorbed a share of the industrial engineer's interest in 1953. The industrial field a three-dimensional floor layout planning system using acrylic scale models and a transparent acetate film sheet (23).

Business Machines

As streamlined design continues to change the face of the modern business office and as automatization continues to change the pace of modern business life, plastics continue to move into prominent position in the construction of business machines. In 1953, of the several new units announced — ranging from gigantic electronic calculators to small, but equally important, hand-operated adding machines — the majority incorporated plastics in one form or another.

The "thinking" machines, although representing a limited and specialized market, exemplify the impor-

Courtesy Polyplastex United, Inc.

Decorative laminates find use in screens, vertical blinds, upholstery, and table tops

Courtesy Bolta Product Sales, Inc.

Vinyl-surfaced tile is easily pressed into place on wall covered with an adhesive

tance of the light weight, design potentialities, and physical properties of plastics to the success of many of today's business machines (24). A huge number of plastics components — running well into the tens of thousands and incorporating a wide range of materials — go into the construction of each of the electronic computers.

Smaller business machines that were improved in appearance and operation by the addition of plastics parts include a dictating system with cellulose acetate butyrate cover, front plate, and dial (25) and an adding machine housed in a molded styrene case (26).

A new field for plastics in the world of business — and one that should prove fertile in the years to come — is in the construction and decoration of office furniture. In 1953, two developments were announced that should send this application phase off to a flying start. Each of these developments involved the use of reinforced plastics. The first was a reinforced plastics file drawer and work tray with a molded styrene alloy front (27), and the second, a reinforced plastics swivel desk chair (2).

Printed Circuits

The use of plastics in printed circuitry continued to expand in 1953 not only in volume but also in the different types of plastics used. Although at least 90% of the printed circuitry now on the market makes use of a paper base phenolic laminate as support for the copper foil conductor, practically every kind of plastics can be employed in these circuits in one form or another.

Prospects for printed circuits in 1954 are big. One large automobile manufacturer is currently evaluating an automobile radio which has a great deal of printed circuitry in its make-up. And one large radio manufacturer expects to place three broadcast receivers on the market in the Spring of 1954 which will have similar components.

Until a short time ago, it was necessary to use intricate "plumbing" in hooking-up microwave radio receivers, because of the necessity of using coaxial cable in the hook-up. A development called microstrip wiring, by permitting a great reduction in weight for microwave receivers, has solved the problem. One receiver, for example, that previously weighed 32 lb., has been reduced in weight to only 5 lb. through the use of printed circuitry. The microstrip wiring consists of a fibrous glass-silicone laminate with copper foil on both faces — one face being processed for the printed circuitry, with the solid copper foil on the opposite face serving as the ground element.

Toys

Toys, as usual, were an excellent market for plastics in 1953. Standard applications, such as model autos and boats, dolls, toy guns, and similar colorful and inexpensive toys, captured the bulk of the plastics toy markets. And, again as in previous years, many of these toys were badly engineered and poorly made plastics items. Despite repeated warnings as to the eventual disastrous results of such operations (28), a few molders continued to sacrifice quality for penny savings.

There was, however, a ray of hope in the fact that others of the plastics toys that appeared in 1953 did show evidence of more imagination and a sounder approach to the use of plastics. One outstanding example of the trend in this direction was a rugged

Courtesy General Motors Corp.

Corvette sports car rolls off first assembly line to be laid out for production of automobiles with complete bodies molded of fibrous glass reinforced plastics

hobby horse molded of cellulose acetate butyrate (29). Realistic design was coupled with life-like coloring in this application.

Realism was also a major feature of several other unusual plastics toys placed on the market in 1953. These included a children's stamp pad in the form of a typewriter (30) and a fishing set for children that contained a reinforced plastic rod and a colorful molded styrene reel (31). A modeling kit using a vinyl plastisol that is non-sticky, soft, and more easily worked than clay was also introduced during the year (32).

Hobby kits containing detailed molded acetate parts that can be assembled into authentic antique autos, boats, and airplanes were one of the largest selling plastics toys of the year (33). Backed by an aggressive merchandising program, the ready-to-assemble construction kits forged to a position among the leaders in sales to hobbyists.

Although polyethylene applications in the toy field were rather limited in 1953, there is good reason to believe that in 1954 the material will find wide volume usage for infant items (such as teething rings, rattles, etc.) as well as for model trucks, fire engines, etc. that are safe for play and will not break when bent, dropped, or twisted (16). The crop of polyethylene toys that came out in 1953 included a set of nesting blocks, a floating juvenile hand brush, and model toy soldiers.

But perhaps the most significant illustration of the relationship of plastics to the toy field was afforded by the market that opened up for the material in the production of space toys and games (34). Here was a completely new phase of the toy field in which the toy manufacturers had turned *first* to plastics materials.

The majority of ingenious toys offered to the space-conscious youngster were designed exclusively for plastics. Since the space fad had sprung up in the middle of the "plastics era in toys," there were no similar products made of non-plastics materials which could be used as yardsticks.

If the space toys can be taken as criteria, the toy industry may well be breaking away from the mass-production of cheaply-made and easily-destroyed toys — and on the road towards a new concept in the use of plastics materials.

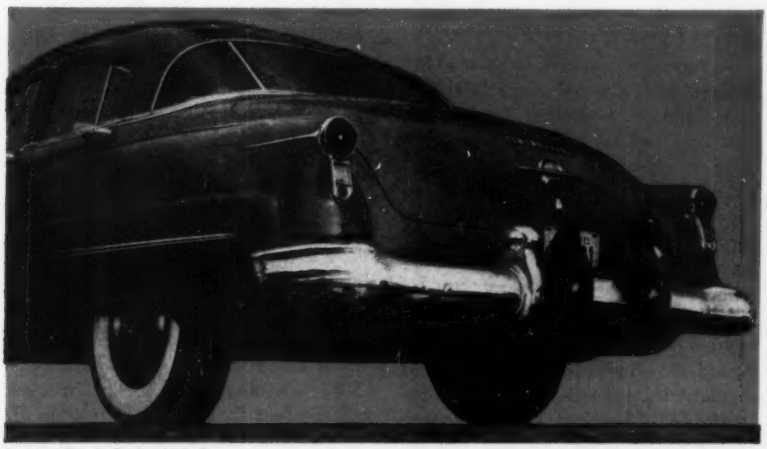
Automotive

It did not require any crystal ball to predict, on the basis of the events of 1952, what would happen to plastics in the automotive field in 1953.

The enthusiasm that greeted the original introduction of fibrous glass-polyester automobile bodies continued to mushroom at a fantastic rate until the plastics car bodies had become the hottest thing in the car market. The February issue of MODERN PLASTICS reported on the application as one with a fabulous potential, but one that was still in fairly limited production (35). As that issue went to press, however, several leading automobile manufacturers — Kaiser-Frazer, Buick, Chevrolet, etc. —had already taken the idea of plastics car bodies under their wing and had placed it in the hands of their design engineers.

By the end of the year, the first assembly line for the mass production of plastic car bodies was put into operation by Chevrolet (36). Capable of turning out as many as 30 sports car bodies daily, this line heralded the opening of a new era for reinforced plastics in the automotive industry. Plastics car bodies were on their way!

In a sister industry — the manufacture of commercial trucks — reinforced plastics applications similarly moved into prominence. One



Courtesy The B. F. Goodrich Co.

Inflated vinyl plastisol automobile bumper guards serve double purpose of protecting the car and cushioning shock

Large variety of items, ranging from poker chips and compartmented case to battery grommets (bottom, left), typifies molded polyethylene applications

Portable record player weighs only 6 lb., has colorful molded styrene case

Back, arms, and seat of chair are covered by sprayed-on vinyl sheeting

company fitted its truck-trailers with reinforced plastics sides, roof, and doors—strong, corrosion-resistant, and so light that payloads could be profitably increased (37).

The poundage of plastics used in commercial autos also increased in 1953. The cranking motors and the generators which keep the car battery charged, for example, were being designed in 1953 with more vinyl plastisol, ethyl cellulose, nylon, and phenolic parts (38). Tension wires for seat cushions were dipped in vinyl plastisol to reduce noise and protect the wires against moisture and wear (39). Slush molded plastisol bumper guards were added to the front and rear of autos to cushion shocks (40). And an air conditioning system for the convenience of automobile passengers used acrylic ducts to distribute the air (41).

Perennial large-volume market for plastics, the housewares field accelerated its pace in 1953. Estimates for 1953 placed the poundage of plastics being used for these applications at 50 to 60 million pounds.

Housewares

One reason for this expansion, according to reports from the field, was the fact that plastics housewares items being marketed seemed to display more imaginative thinking and better design than has been customary in the past.

In the vinyl field, for example, reports from the 1953 Housewares Show indicated that the manufacturers had taken the advice of the Film, Sheeting, and Coated Fabrics Conference as to the need for improvements in styling and quality (42). New designs created especially for vinyl film and sheeting, and new methods of finishing, ranging from flocking to scenting, were put on display by many manufacturers.

Styrene applications, in several instances, also showed more imaginative thought in design. Among the new applications introduced in 1953 were a styrene swivel buffet that swung open to provide access to seven separate wells (43), and a handsome, heat-resistant carving tray molded of high-impact styrene (44).

One outstanding application molded of urea was a safety knob designed to eliminate the dangers of accidentally turned-on gas or electricity (45). Another urea usage was in a molded urea salt and pepper shaker set of unusual design. This set fits into a special pocket of a new General Electric stove and complements the unit's modernistic motif.

Melamine strengthened its position in the dinnerware field in 1953. New and more attractive patterns and shapes in melamine dishes, cups, and saucers claimed the attention of more potential customers (46). The advantages of melamine in dinnerware also served to promote the use of the material for other applications that required similar characteristics. One leading manufacturer of soda fountain equipment introduced a new line of washable, colorful paper cup holders molded of melamine (47).

For polyethylene housewares applications, the events of 1953 indicated that much was still in store for the material. One survey indicated that it is in the housewares field that polyethylene is expected to have its biggest expansion (16). Once polyethylene is available in assured quantities to encourage molders to take the wraps off new applications, a flood of polyethylene products for a multitude of uses can be expected. In the meantime, polyethylene bowls, trays, combs, beverage shakers, and wastebaskets are being put on the market. Other polyethylene applications include a squeeze bottle window cleaner, with a squeegee attached (48), and a molded polyethylene gadget tray designed to accommodate odd-shaped kitchen tools (49).

Phenolic handles gained impetus in plastics housewares sales by the development of high speed molding techniques designed to cut production and material costs (50). The handle market also absorbed several other plastics in 1953 — cutlery handles molded of melamine (51); steak knife handles molded of cellulose acetate butyrate (52); and cutlery handles molded of cellulose acetate (53).

This expansion in the use of plastics for handles was indicative of the strides being made in the use of plastics for similar — undramatic, unheralded, but vitally important — housewares applications. One report from the Housewares Show stated that at least 20 million lbs. of phenolic alone would go into handles in 1953 — a staggering figure in view of the fact that only 160 million lb. of phenolic resins were sold in 1952.

Along similar lines, the amount and variety of plastics going into household appliances took a terrific jump. In the refrigerator field, for one, the total poundage used by one manufacturer in a 1953 model was almost double that used in the 1952 model (54). Air-conditioning units — one of the hottest sellers in the appliance field — also took on more plastics parts than ever before (55). In 1953, the potential of room air conditioners as a market for plastics was further increased with the introduction of a one-piece molded styrene housing for the unit.

Furniture and Architecture

The functional, decorative, and economic possibilities of furniture molded of plastics have been a fa-

(*Continued on p. 172*)

Materials Developments: 1953

by John M. DeBell

IN THE past year, with practically all plastics materials fully available for the first time in history, considerable development went on at material chemistry levels.

A number of new materials have been introduced; these have been modifications of older ones. In a general way, I am glad to report that there is continual progress in that famous search in the plastics field for "a transparent, stainless steel which is a non-conductor of electricity, has a specific gravity of less than one, makes good automobile tires, and costs less than eight cents per pound!"

In the vinyl chloride field, emphasis is being placed on the rigid vinyls and on pastes. Practically all of the vinyl chloride suppliers now have paste resins of the stir-in type, which can be easily incorporated in plasticizers and which fuse on momentary exposure to high temperatures—around 160 to 170° C.

In the rigid vinyl field, the tendency is towards polymers or copolymers which will extrude or press easily, which can be readily welded, and which have improved toughness over the standard high molecular weight polyvinyl chlorides. This toughness is accomplished not only by copolymerization, but also by admixture with synthetic rubbers, particularly of the acrylonitrile type, and other rubbery copolymers. Rigid vinyl compounds with greatly improved impact strength—10 to 15 ft. lb./in. as exemplified by Geon 8700—will presently be available from all major producers.

Goodrich and Monsanto, among others, have encouraged dry premixes of resins and plasticizers which eliminate one heating and compounding operation. Note U.S. Patent No. 2,530,852 and various others on powder compounding and moderate heat treatment of polymers. Heavily filled compounds which use so much filler that the rigidity is, as a practical matter, retained in spite of small amounts of plasticizer, are finding application in large pipe fittings and in asbestos-filled flooring. Vinyl chloride latices and intumescent coatings are both in active development.

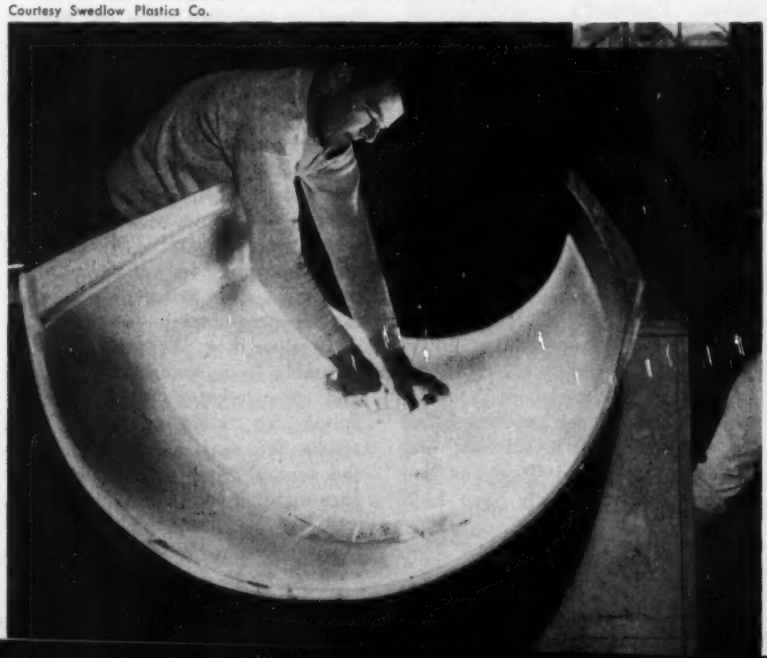
Prepared from an address given before the New England Section of The Society of the Plastics Industry, October 8, 1953.

THE AUTHOR

John M. DeBell, president of DeBell & Richardson, Inc., is a graduate of M.I.T. in chemical engineering. He has pursued a career in plastics which includes some 10 years with General Electric Co., four years with Hercules Powder Co., two years with Fiberloid Corp. (now merged with Monsanto Chemical Co.), and outstanding work since 1939 as an independent consultant.

During World War II, Mr. DeBell worked closely with several government agencies and was a member of the team which investigated the German plastics industry for the Army.

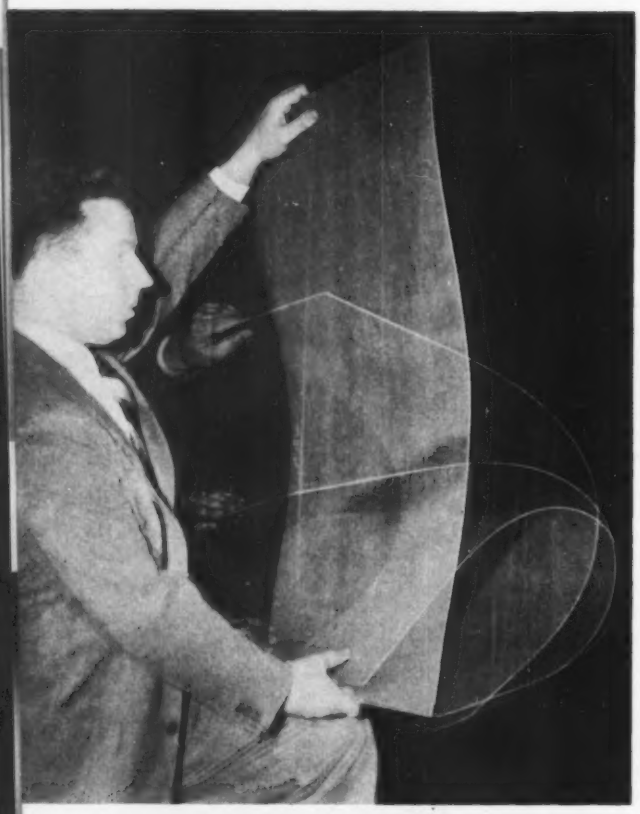
Essential antenna wires, covered with extruded acrylic, are cemented to inside surface of acrylic aircraft canopy prior to its installation on the plane
Courtesy Swedlow Plastics Co.



Tough Styrenes

In the tough styrene field, which was probably initiated by the high-styrene copolymers for shoe soles, like Goodyear Neolite, the impetus given by Dow 475 and its homologues seems to be spreading. Not only are more high-styrene polymers available, but also there are innumerable variants on the general theme of admixing these with small amounts of rubber, usually of the hydrocarbon type, to control all degrees of toughness.

Thus, the important and growing field of vacuum forming of sheet is now serviced by rigid polyvinyl chloride, by these tough styrenes, and also by tough oriented pure polystyrene like Plax Polyflex. Still tougher mixtures are feasible by mixing the copolymers of acrylonitrile and styrene with acrylonitrile



Multiple exposure photo shows how laminates made with a new rubber-phenolic varnish can be flexed without breaking. These laminates also exhibit high resistance to impact

Courtesy General Electric Co.

Courtesy United States Rubber Co.

Styrene copolymer meter register cover and housing are strong and tough

rubbers. Polymers of this type, such as those furnished by U. S. Rubber, and certain of the cellulosic plastics, are distinctive in that, within limits, they are malleable enough to be reformed into strong, coherent pieces by impact. This quality has usually been found only in metals. Acrylonitrile seems headed for large applications in the tough, copolymer field along with textile fiber uses.

Rubber Polymers

In the rubber field itself, the important new polymers were admirably summarized by G. W. Kuckro of General Electric Co., in a Bridgeport address earlier this year, as the ethyl acrylate polymers which are quite good for heat resistance, aging, and oxidation; polybutadiene made with alfin catalysts which give high tensile and abrasion characteristics; Du Pont Hypalon, the chlorosulfonate of polyethylene which shows extraordinary aging stability; new Redox system cold rubbers; the sodium activated copolymers of the Germans which showed good flex cracking and hysteresis; and the Leverkusen and Goodyear isocyanate rubbers which have high tensile strength and fine abrasion resistance without carbon black.

Vinyl toluene, coming into supply from Dow and American Cyanamid, promises to extend the use of "styrenated" oils to less saturated and cheaper glyceride oils than have heretofore been used. Rohm & Hass now offers an acrylic for water base paints, and these and the alkyds are beginning to supplement the well established styrene butadiene coatings. Butyl rubber—itself one of the cheapest of polymers—is now being suggested by Esso Standard as a tire carcass material for some uses, particularly agricultural, where a less nervy structure is desired. The gas stopping propensities of this material will also be utilized. While its close relative, high molecular weight polyisobutylene, is not too widely used in this country, it has shown so much success in heavily loaded stocks in Germany that we anticipate growth in this field.

Also in the rubber field, General Electric Co. has added new materials to its already established line of rubber phenolic molding compounds. In addition to the high shock resistance of these materials, there is now available a laminating resin which permits a flexibility to give shaped electrical components which were hitherto impossible without post-forming techniques. Glass-phenolic molding compounds, as made by Fiberite, are reported to develop 10 to 15 ft. lb./in. of notch. Phenolic resin use in foundry casting continues to grow.

Polyelectrolytes, starting with Monsanto's Krilium, are not only used to mulchify soils, but also to improve clay texture in sand-clay foundry mixtures and to film the walls of oil shafts. Where nitrogen is absent from these materials, there is no competition from the cow.

Melamines, in addition to their established position in tableware, decorative laminates, and other water resistant uses, have achieved new importance in wet strength paper and textile treatment. The related benzoguanamine resins, which were described in 1945, are now available from American Cyanamid and are reported as particularly suited for surfacing cheap core stocks for vertical surfaces. Note the general trend toward low pressure molding compounds made from

various base resins, with consequent major saving in investment.

Polyethylene is becoming available from both United States and European producers in smoother, more readily workable formulations. Materials with comparatively high melt indices have the smooth extrusion quality and capacity for blowing which was previously associated only with very high molecular weight materials.

New Polyethylenes

The most important new chemical derivative of polyethylene appears to be Du Pont's Hypalon, already referred to. Since this has no unsaturation, it has complete resistance to ozone and involves no aging problem. It vulcanizes readily, however, and also mixes well with other rubbers, and in small admixture with butyl greatly increases in stiffness. Of developmental interest is the General Electric cathode ray irradiated polyethylene, which is reported to have form stability to 200° C. and a tensile strength of 100 to 200 p.s.i. at 125° C. Various means have been found, some patented, to increase the printability of polyethylene film which can be done both by coating and by chemical treatment of the surface. Bakelite Co. has recently called attention to the method used by one of its customers—Chester Packaging Products Corp.—to improve polyethylene film. A copolymer all the way from carbon monoxide and hydrogen was described by Du Pont as fiber forming and high melting.

The epoxy resins, which are often based on bisphenol, are now expanding quite far beyond their original uses as adhesives and protective coatings. Not only have they shown excellent promise in glass laminates, along with regular polyesters, but they are also of considerable value in the preparation of very lightweight, strong heat resistant foams, with a weight of 2 lb. per cu. ft., developed chiefly for the Armed Services.

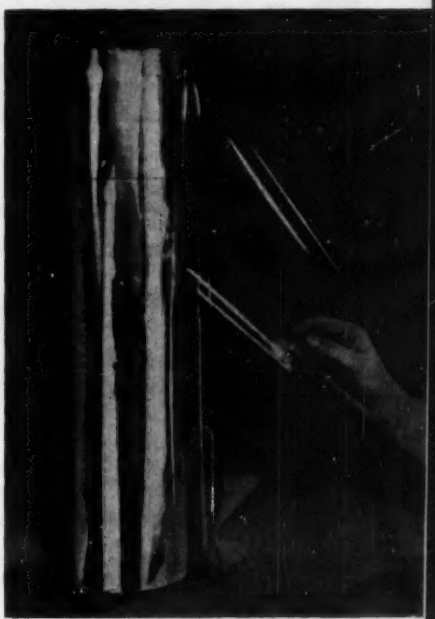
Temperature resistance of the polyester structures is improved by special monomers such as American Cyanamid triallyl cyanurate.

The field between polyesters and methacrylate is being narrowed in connection with airplane transparents. The methacrylates are now appearing in slightly cross-linked forms in order to get less crazing and more toughness while the polyesters are being produced in more flexible form of greater toughness. Rohm & Haas Plexiglas 55 and Polymer K represent major advances in craze resistance for cast acrylic sheet, and the latter has higher heat resistance. The same company has experimentally shown improved craze-resistance and less shattering under bullets when the methacrylate sheet is stretched and oriented. From the extrusion types of methacrylates, extruded sheet, both oriented and non-oriented, is now available.

Isocyanates

Mentioned earlier were the isocyanates which seemed to be an important class of materials as early as our visit to Germany immediately after the war. Independently, or through arrangement with Farben Fabrik Bayer, we understand that Goodyear, Goodrich, and U. S. Rubber will all have position in the isocyanate rubbers shortly. These are linear alkyds which have been lengthened by isocyanates and then treated with glycols or diamines to cross-link to become an extraordinary abrasion resistant material. In other modifications, and by the same process, these can be cast into small gears which are reported to outwear the polyamide types. In foam structures, the isocyanates are performing excellently in radomes; while in Germany we actually saw a beer barrel in which two light metal shells were spaced and insulated by such a foam. In this coun-

(*Continued on p.* 179)



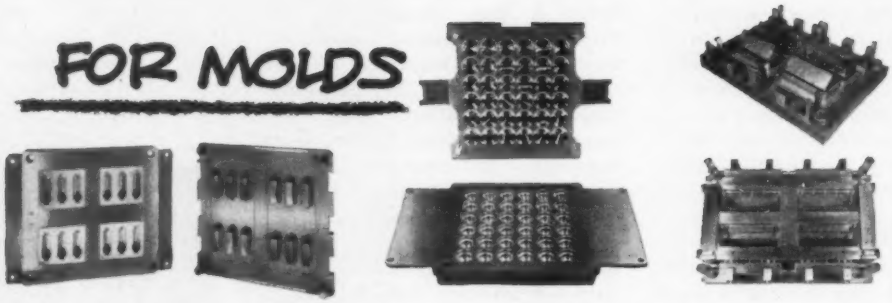
Courtesy E. I. du Pont de Nemours & Co., Inc.

Transparent Mylar polyester film has high tensile and compressive strengths

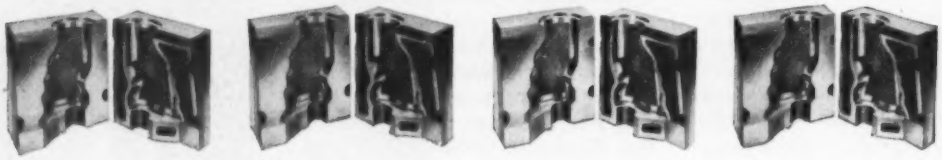
Courtesy Bakelite Co.

Work gloves that grab and hold on slippery surfaces have cloth base coated with vinyl resin to which inert particles have been added

FOR MOLDS



FOR HOBBED CAVITIES



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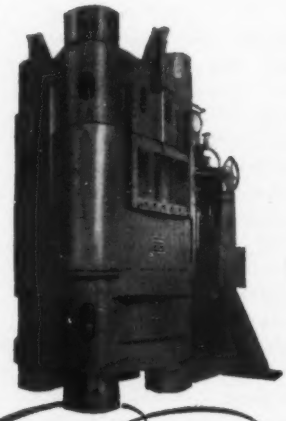

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HOBBED CAVITIES
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MIDLAND DIE AND ENGRAVING COMPANY

1800 W. Berenice Avenue • Chicago 13, Illinois

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

Engineering Progress in 1953

EXPANSION in molding capacity in 1953 was the largest in the history of the plastics industry. This fact is clearly shown by the figures on delivery of injection machines, both domestic and foreign, given on page 115 of this issue.

At least three additional companies entered the field of injection machine manufacture. Three new companies are now producing equipment for vacuum forming. Rigid vinyl was injection molded on a production basis for the first time. Several 200-oz. injection machines which cycle (dry-run) in 10 sec. were placed in operation. The wide acceptance of weigh feeding devices has proved the ability of this equipment to improve quality and production of molded pieces.

The increase in the use of reinforced plastics has been phenomenal. Automobile bodies are being made on a production basis. Tanks of all sizes up to capacities of 3400 gal. were produced. Thousands of boats were made and sold. Over 16 million sq. ft. of translucent structural sheet were produced. Dies for drawing and stamping steel have proved successful for large production runs.

These are just a few examples—many more were cited in MODERN PLASTICS during 1953. In addition to the articles reviewed in the following pages, complete details on the subjects listed in the next few paragraphs were included in the Engineering Section of MODERN PLASTICS magazine during 1953:

"Setting up a Plant for Custom Molding Reinforced Plastics" (Feb.) outlined the capital, equipment, personnel, management, and sales effort needed to set up and operate a custom molding reinforced plastics plant.

"Quenched Fluoroethylene Film" (Feb.) described the method for processing this film and outlined the advantages gained by rapid quenching.

"Basic Principles of Injection

(*Continued on p.* 180)

* Reg. U.S. Pat. Off.

Plastic Metal-Forming Dies

SOME four years ago, Briggs Mfg. Co., Detroit, Mich., started experimenting with plastics resins and reinforcements in a development program on metal-forming dies. In 1951 the company was awarded a large contract for the manufacture of aircraft sub-assemblies requiring many formed sheet aluminum parts. By this time, work had reached the point where the feasibility of using reinforced plastics dies for aluminum forming had been proved.

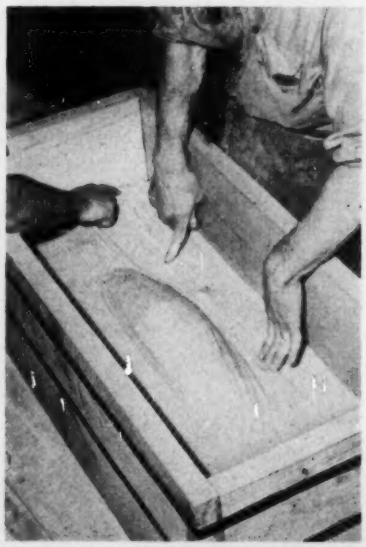
But this was only the beginning. Briggs was aiming at the forming of steel with plastics dies.

Because a steel die maker was late in delivering a set of five dies for Plymouth and Dodge underbody brackets, the plastics division of Briggs was given an opportunity to prove that its dies could not only form these parts from cold rolled steel ranging in thickness from 0.030 to 0.050 in., but also that it could get such dies into production rapidly. Speed was required because the lack of these automotive components was holding up the Plymouth and Dodge assembly lines. The design of these five dies required a total of 20 plastics working details. The dies were engineered, molded, finished, and tried out—the latter operation required running 360 trial stampings—in a total elapsed time of only 250 man-hours.

Long Life

The use of these plastics dies for this particular job was admittedly a stop-gap. No one knew how many stampings could be made before the plastics dies wore out. As a matter of fact, it was only necessary to run 700 stampings from each die before the steel dies were completed;

Tailored lengths of resin-impregnated glass rovings are laid up on pattern in mold box to form face of draw die



Photos courtesy Briggs Mfg. Co.

Special set-up used in impregnating fibrous glass rovings. Rovings from bank of coils pass through tank, at end of which all the strands are combined to form one rope

the use of the plastics dies, however, was well justified if for no other reason than that it permitted the assembly lines to start and keep running. The big surprise was that at the end of the run the plastics dies were in just as good a shape as they were at the beginning.

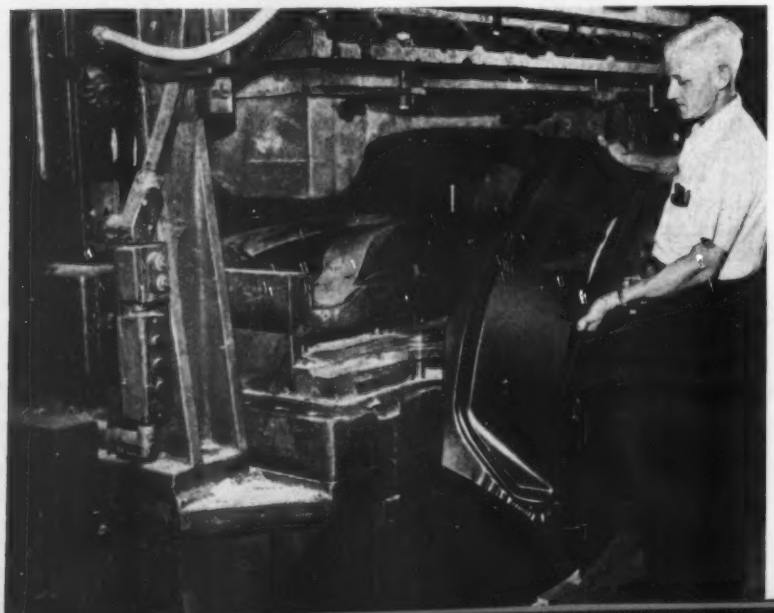
With this successful start, Briggs continued to build reinforced plastics dies for stamping steel. Certain dies have now run 35,000 parts without appreciable wear.

These parts are being drawn from steel ranging in thickness from 0.035 to 0.060 inch. In experimental work, cold rolled steel as thick as 0.070 in. as well as 0.035-in. stainless steel have been drawn successfully.

In producing dies for aluminum, multiple coils of fibrous glass rovings, usually 10, are set up on a rack in such a way that each roving may be fed through a special device developed at Briggs for separately impregnating each strand, combining all strands into one rope, and metering the amount of resin picked up. As the combined strands are drawn from the metering device in the impregnating tank they are cut to predetermined lengths and carefully laid up on the model until the required thickness for the lay-up has been reached.

If dies for steel are to be made, the face is made up of tailored layers of impreganted cloth instead of rovings, laid up on the model in the same manner. From this point on, the production steps are the same whether the die is to be used for forming aluminum or steel. The polyester resin used is so catalyzed that no external heat is required for gel and cure.

Cold rolled steel blank has been formed into automobile sun visor on plastics die



Impregnation

Two-inch lengths of chopped fibrous glass are placed in an impregnating box. The quantity of chopped glass is determined by the over-all volume of the die less the volume taken up by the face. After the required amount of glass is placed in the box, a quantity of resin, weighing approximately the same as the chopped strands, is poured on top of the strands. A perforated cover is then placed on top of the resin-glass mixture and the entire impregnating unit is placed in an air press where from 10 to 20 p.s.i. are gradually applied, forcing the resin into the voids existing within the fibrous glass.

The impregnation tank is then taken out of the press, the top plate taken off, and the mixture removed from the tank and loaded on top of the facing in the mold box. When all of the chopped strand has been loaded in the box, a top plate of soft pine, cut to fit the inside of the box, is placed on top of the mixture.

Die shoes then go on top of this plate and the entire set-up is loaded into an air operated press.

Indicating marks on the side of the die shoes show the press operator when the "home depth" has been reached. In this manner, the over-all height of the plastics die is controlled to its predetermined dimension within close tolerances.

After the "home point" has been reached, using a closing pressure of somewhat over 20 p.s.i. of projected die area, the press is locked in that position and curing proceeds. Time for cure varies from 6 to 8 hr., according to the catalysts and activators in the resin.

After curing has been completed, the plastics die is removed from the die box and placed in an oven for post baking or annealing, which takes approximately 72 hr., with an oven temperature ranging from 200 to 250° F.

The steps just described produce the female half of a metal forming or stamping die. In order to produce

the male half or punch, the female plastics die is loaded in a mold box with a suitable parting agent on its surface and the various steps are repeated. When necessary, the female plastics die is covered with lead foil or wax to provide clearance between punch and die, as required by the metal-forming operation to be accomplished.

Another feature of this type of die and punch is that when and if certain sections should wear, repair is simple and can be completed quickly by the addition of tailored areas of glass and resin.

(MODERN PLASTICS, September 1953)

High-Speed Preplasticizer

TERMED "the fastest injection machine ever built" and "the first high-speed big injection machine ever offered the plastics industry," the Model 1200-P-200, introduced by The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, completes a dry cycle in 10 seconds.

The new unit is described as having an injection speed of 200 oz. in 3 sec., a positive shot measuring device, and a preplasticizing chamber which plasticizes independently of the machine cycle. The machine also has high-speed clamp build-up (it closes the mold and develops full clamp pressure of 1200 tons in 3½ sec.), hydraulic ejectors on the stationary die-head side to eliminate the use of pull chains when ejection is from the sprue side, and a built-in hydraulic mold elevator and positioner to reduce mold setting time.

Eight of these new models are now in use. Although they were designed for production of large parts such as refrigerator doors, they have been profitably applied to production of smaller parts. For example, a 26-oz., 450-sq. in. part was molded in 22 seconds.

It is stated by H-P-M engineers that this new machine is revolutionary in three ways. First, plasticizing is completely independent of the machine cycle in that material is constantly being plasticized regardless of the position of the injection plunger. This means that there is always an extra 200-oz. reservoir of plasticized material for the next shot.

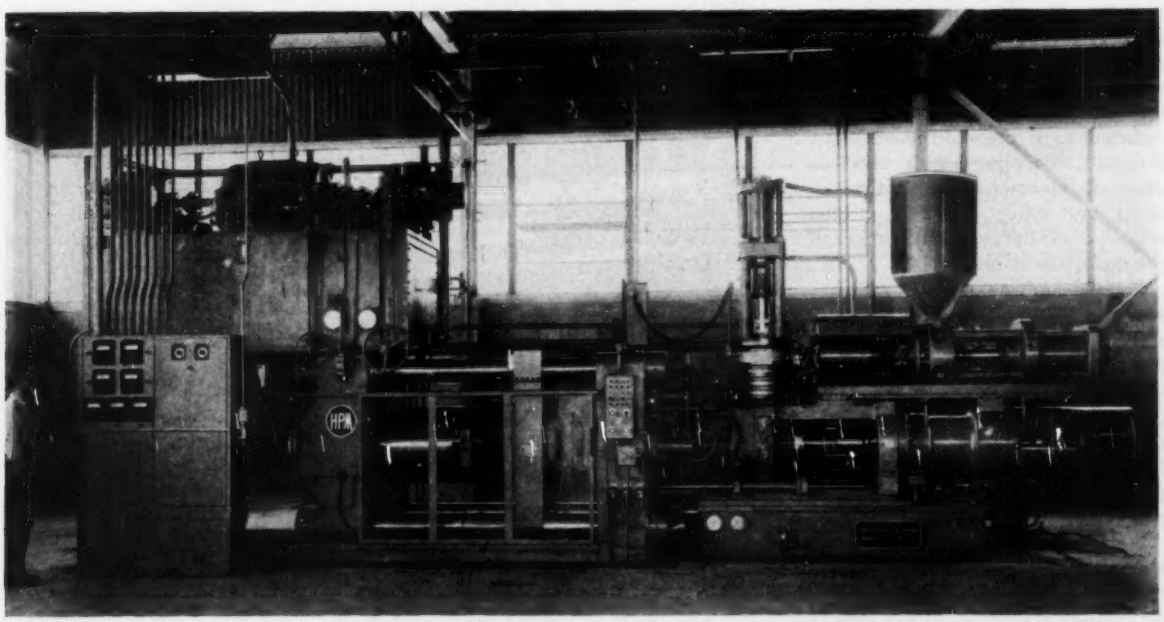
Second, an adjustable hydraulic injection tail rod assembly assures positive shot measuring. With the tail rod nut properly adjusted, it is impossible to apply excessive pressure on the part in the mold. This shot measuring device also protects the mold against the injection of more plastic than required to make the part, minimizing the possibility of jamming valuable cam actions or distorting cores or ejector pins.

Third, the use of chains or pull rods is eliminated when ejection is from the sprue side. Four hydraulic ejector rams, located on the stationary die head side, eliminate pulling mechanisms.

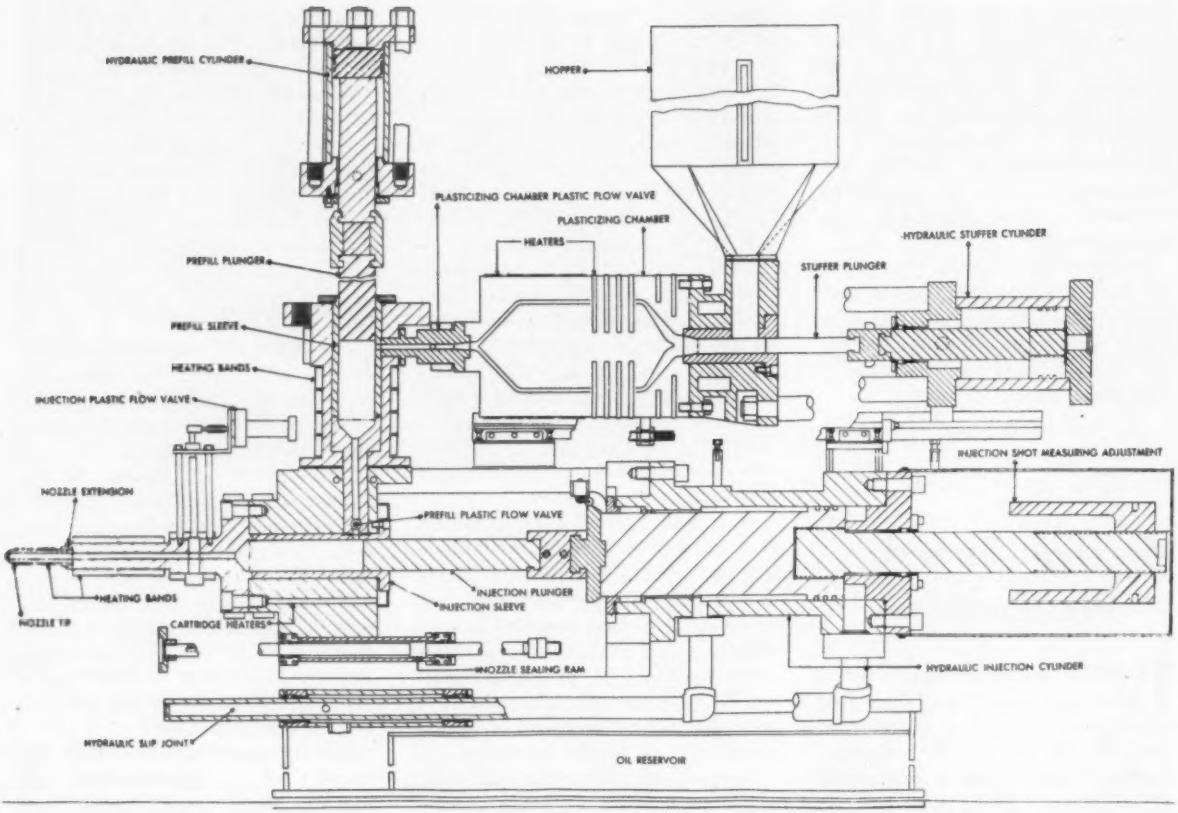
Double Acting Ram

The hydraulic mold clamp has a double-acting ram, the main ram being equipped with a small internal booster ram which closes the clamp platen to within a fraction of an inch of the total clamp stroke. At this predetermined position, hydraulic pressure is shifted to the large ram area. This means faster closing because the fast closing booster ram does most of the work. On the return stroke, clamp opening starts at slow speed to separate the mold, shifts to high speed, and then automatically slows down before contacting the ejector bar.

The hydraulic injection unit also consists of a double-action ram working in a smooth-bored steel cylinder. Both the cylinder and injection unit are mounted together on ways and are moved hydraulically. When the clamp closes, pressure on the nozzle sealing cylinder



Over-all view of Model 1200-P-200 injection molding machine, said to have an injection speed of 200 oz. in 3 seconds



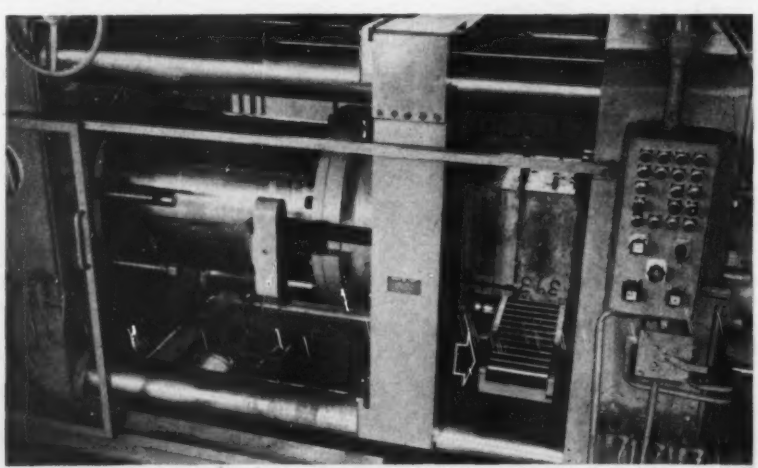
Schematic drawing of injection end of 200-oz. preplasticizing injection molding machine

moves the injection chamber nozzle against the mold. An automatic injection pressure compensating device permits the injection plunger to move forward at a constant speed and high pressure; then, when a predetermined high pressure is reached, pressure automatically is reduced to a predetermined lower pressure. This system is used in place of the mechanical shot measuring unit when a plastic cushion is desired on the injection plunger at the end of its stroke.

Manual controls consist of switches and push buttons for starting and stopping the motor, turning heat on and off, manual and semi-automatic cycle control, clamp control, and injection control. An emergency reverse button returns the clamp to the open position from any point, and a die set-up switch allows slow advancing to protect dies.

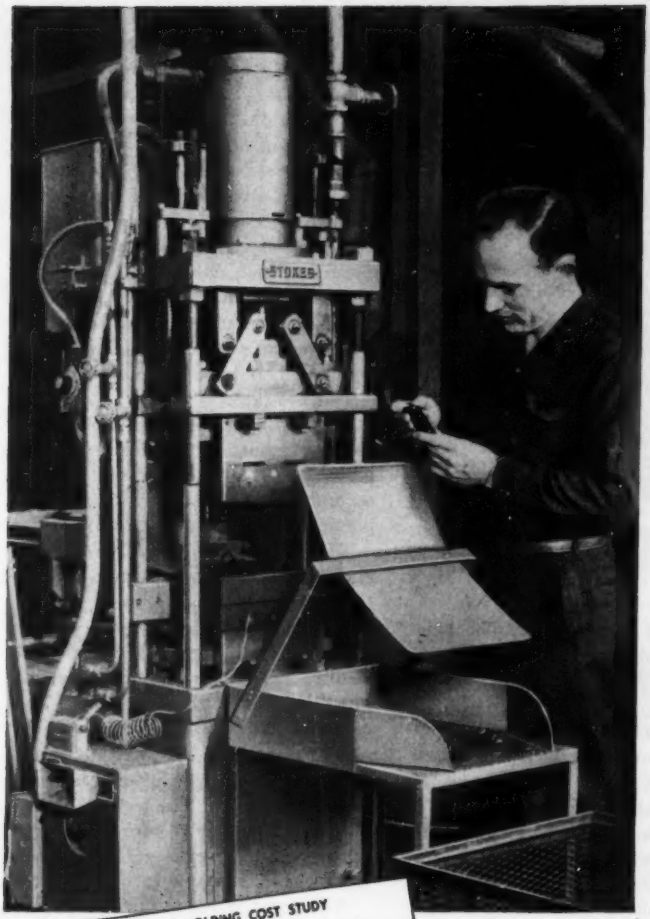
Main operating valves are actuated by pilot cylinders. Micro-flex timers control clamp and injection actions. The operator must close the gate to start each cycle.

The material feed unit consists of a reciprocating plunger, hydraulically operated, which feeds the material into the heating chamber. The action of this feed unit can be most easily described as a "plastic pump," since only a small amount of material is fed on each plunger stroke. This system eliminates the feeding of a large amount of cold material at one time, which would have a tendency to "slug" the cold material

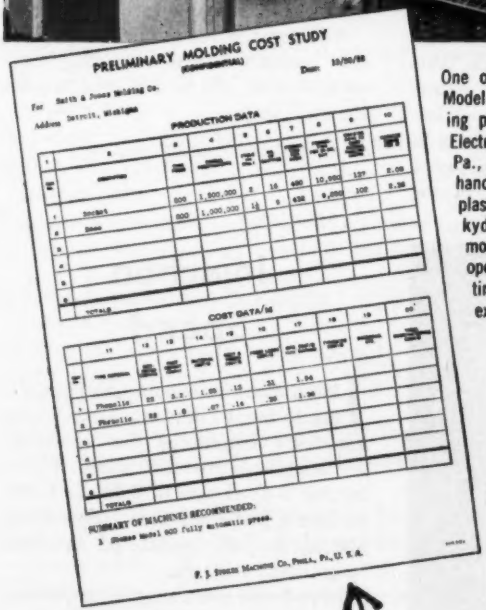


Illustrations courtesy The Hydraulic Press Mfg. Co.

Arrow points to built-in hydraulic mold elevator and positioner of Model 1200-P-200. Purpose of this 25-ton capacity unit is to reduce mold setting time



One of the new Stokes Model 800 plastics molding presses at Sylvania Electric Products' Warren, Pa., plant. Designed to handle all thermosetting plastics, including alkyds without press modification, Model 800 operates on a cycle time of only 5 seconds, exclusive of curing.



PRELIMINARY MOLDING COST STUDY
(CONFIDENTIAL)

For Smith & Jones Molding Co.
Address Detroit, Michigan

PRODUCTION DATA

1	Socket	500	1,500,000	2	16	480	10,000	137	0.09
2	Base	500	1,000,000	16	0	480	8,000	.109	0.36
3									
4									
5									
6	TOTALS								

COST DATA/M

1	Phenolic	50	0.2	1.00	.12	.32	1.64			
2	Phenolic	88	1.0	.01	.14	.30	1.36			
3										
4										
5										
6	TOTALS									

SUMMARY OF MACHINES RECOMMENDED:
3 Stokes model 800 fully automatic press.

P. J. Stokes Machine Co., Phila., Pa., U. S. A.

Typical Stokes report on Molding Cost study of parts to be made by fully automatic molding.

Want to increase your plastics molding production by 50%?

It's possible you can . . . and reduce production costs, too . . . with the new Stokes Model 800 plastics molding press . . . the fastest and most flexible press of its type on the market today.

Sylvania Electric Products, Inc., Warren, Pa., using a battery of five Stokes Model 800 presses, has increased production by 50% on not just one, but fifteen plastic parts used in lighting fixtures, radios, and electronic devices. They've cut production costs, too, because of reductions in mold requirements.

Stokes fully automatic molding presses help plastics manufacturers produce a wide variety of identically accurate parts, of all sizes and shapes, with practically no labor cost. One operator can handle a battery of a dozen or more presses; only periodic filling of the hoppers and removal of finished parts is required.

Send your parts or blueprints to Stokes Advisory Service for report on their suitability to fully automatic molding, and a free detailed product cost analysis. Also send for the Stokes 24-page brochure on Fully Automatic Molding.

F. J. STOKES MACHINE COMPANY,
PHILADELPHIA, PA.

STOKES

STOKES MAKES Plastics Molding Presses / Industrial Tabletting and Powder Metal Presses / Pharmaceutical Equipment / Vacuum Equipment / High Vacuum Pumps and Gages / Special Machinery

and permits each small feed (approximately 8 oz. per plunger stroke) to be progressively moved through the plasticizing chamber. This means that each small feed stays in the plasticizing chamber a longer period of time, resulting in faster plasticizing and more uniformly plasticized material. The viscosity of the material is much im-

(*Continued on p.* 186)

Dual Clamp Machine

DEVELOPED by Lewis Welding & Engineering Corp., Bedford, Ohio, a new machine employs a straight bore, externally heated injection cylinder. The plastic material enters by gravity and is packed into the heating section by multiple injection strokes. This pre-packing serves to compress the material, thus reducing the bulk factor, and insures maximum injection of the plasticized material.

Injection of material into the mold is compensated electrically. By proper adjustment of the control circuits, the machine is set so that the heating chamber is starved by a small amount on each stroke. The injection plunger therefore advances a little farther with each stroke until it strikes a limit switch. It is then returned to a point of maximum retraction and the process of progressive starving starts again. The machine thus completes its feed and injection operations in compensated balance.

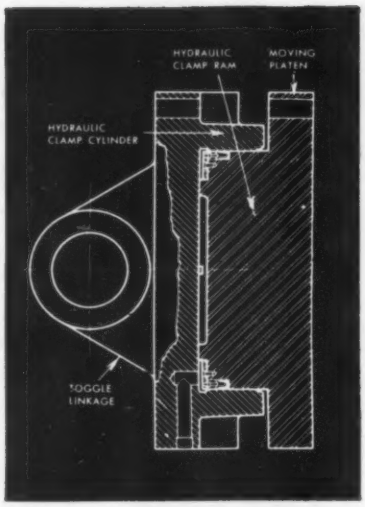


Diagram shows one end of toggle linkage, hydraulic cylinder, and clamp ram

Injection pressures are readily adjustable from practically 0 to a maximum of 20,000 p.s.i. In special cases, this can be increased to 30,000 p.s.i. by reducing the diameter of the injection plunger.

A basically new type of clamping system is incorporated in the machine. Called the "Hydra-Lock," this mechanism is believed by the manufacturer to be one of the most important mechanical contributions to the art of molding in many years.

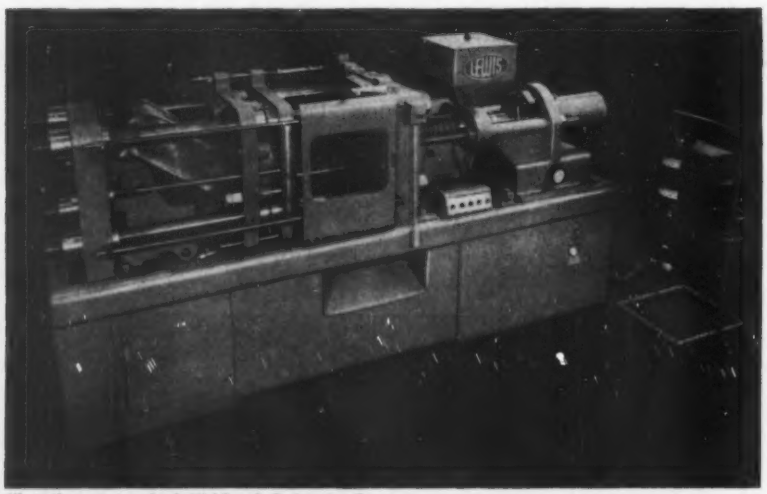
The clamping mechanism of the machine embodies three principal elements. A toggle linkage advances the platen, on which the moving half of the mold is mounted, to a position where the mold faces are open only a fraction of an inch, at which point the toggle is locked. Incorporated in the platen structure is a 16-in. diameter hydraulic cylinder, actuated automatically through the control circuits, which does the final closing of the molds and supplies the final clamping pressure. The toggle mechanism serves as a mechanical locking device to hold the platen in the closed position.

The stroke of the large cylinder is so short that only a fraction of a gallon of oil and a few tenths of a second are required for the hydraulic portion of the clamping cycle.

The design of the Hydra-Lock clamping system makes available to the operator an easy mold setting procedure. The short stroke of the clamping cylinder and the liberal clearances in the guides permit quick line-up of the mold faces. The machine will tolerate considerable mis-alignment of the mold faces but still close and give uniform bearing across the mold. The action of the clamping cylinder is such as to provide essentially ball-and-socket action within reasonably close limits.

All operations of the molding cycle are controlled automatically, but each element can be adjusted to suit the mold in use.

(MODERN PLASTICS, May 1953)



Illustrations courtesy Lewis Welding & Engineering Corp.

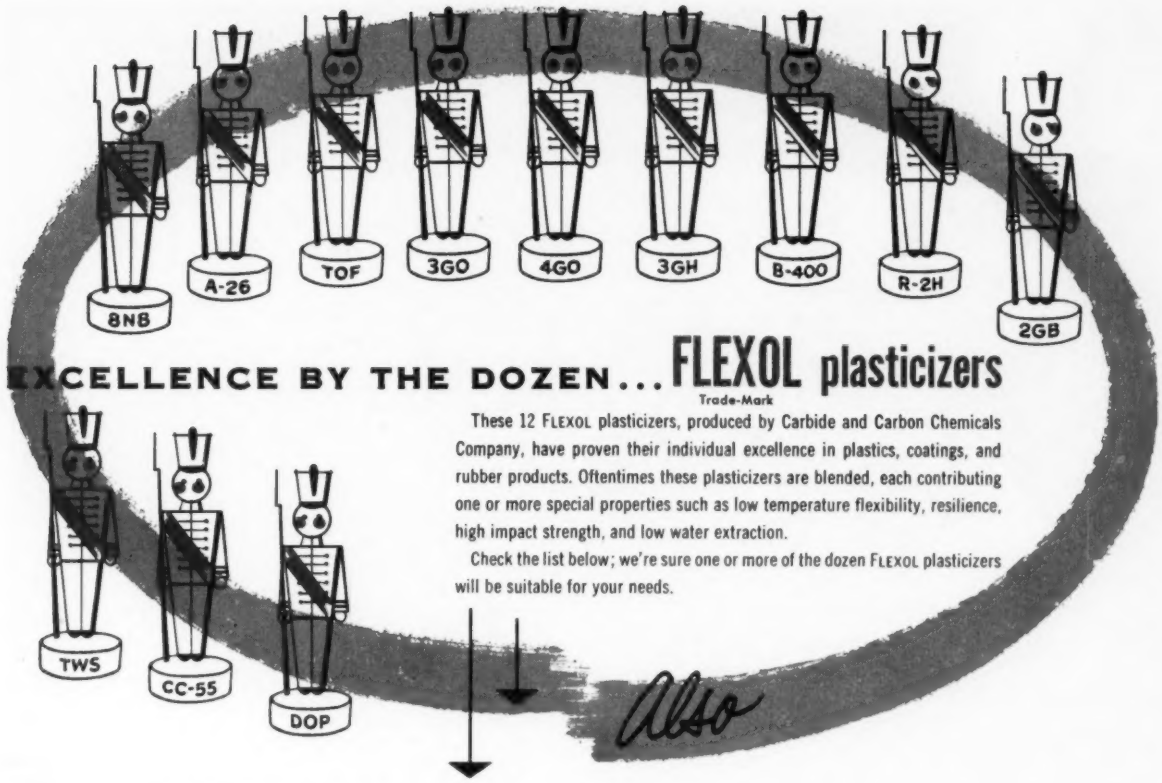
Complete set-up of new injection machine which incorporates ingenious toggle mechanism with hydraulic clamp. Multiple injection strokes reduce bulk factor of material

Injection Speed

THE difficulties encountered in trying to mold thin, large-area parts especially emphasize the necessity for adequate injection speed. Parts having a thickness of 0.080 to 0.100 in. and a projected area larger than 500 sq. in. are considered as thin, large area moldings.

In order to mold such large pieces, the molten polymer must flow so rapidly that the chilled layers which form at the mold surfaces do not become thick enough to choke off the flow of the hot, moving core before the mold is filled.

Parts made with the machine op-



EXCELLENCE BY THE DOZEN... FLEXOL plasticizers

Trade-Mark

These 12 FLEXOL plasticizers, produced by Carbide and Carbon Chemicals Company, have proven their individual excellence in plastics, coatings, and rubber products. Oftentimes these plasticizers are blended, each contributing one or more special properties such as low temperature flexibility, resilience, high impact strength, and low water extraction.

Check the list below; we're sure one or more of the dozen FLEXOL plasticizers will be suitable for your needs.

general purpose primary plasticizers

FLEXOL DOP

[di(2-ethylhexyl) phthalate]—The "Top Kick" plasticizer for vinyl chloride resins.

FLEXOL CC-55

[di(2-ethylhexyl) hexahydrophthalate] for low viscosity plastisols—Improved low temperature properties.

FLEXOL TWS

(tetrabutyl thiodisuccinate)—An unusually non-volatile monomeric plasticizer.

FLEXOL 8N8

[2,2',(2-ethylhexamido) diethyl di(2-ethylhexoate)] — A vinyl resin plasticizer with very low volatility.

for low-temperature flexibility

FLEXOL A-26

[di(2-ethylhexyl) adipate]—Low viscosity plastisols with excellent viscosity stability.

FLEXOL TOF

[tri(2-ethylhexyl) phosphate]—The outstanding low temperature plasticizer . . . with flame resistance too.

FLEXOL 3GO

[triethylene glycol di(ethylhexoate)]—Low temperature plasticizer for neoprene and other synthetic rubbers.

FLEXOL 4GO

[polyethylene glycol di(2-ethylhexoate)]—an excellent nitrocellulose lacquer plasticizer at moderate cost.

FLEXOL 3GH

[triethylene glycol di(2-ethylbutyrate)]—The outstanding plasticizer for polyvinyl butyral.

FLEXOL B-400

(Polyalkylene derivative) — A nitrocellulose plasticizer which is neither an oil nor an ester.

FLEXOL R-2H

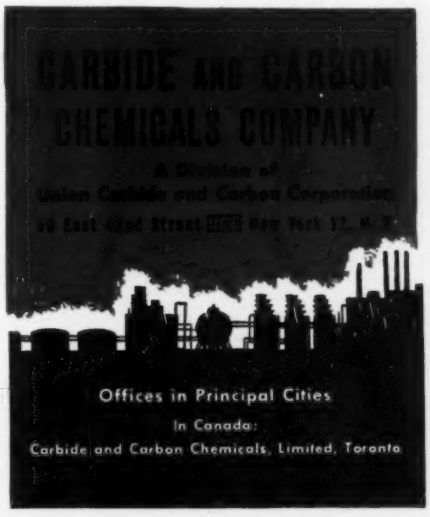
(polyester)—A non-migrating, extraction resistant polymer with good electrical properties.

FLEXOL 2GB

(diethylene glycol dibenzoate)—High solvating action on vinyl chloride resins.

For more information on plasticizers, write for your copy of "FLEXOL Plasticizers," (F-5882). In Canada: Carbide and Carbon Chemicals, Limited, Toronto.

"Flexol" is the trade-mark for Union Carbide's family of plasticizers.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How many will break?

Just three of these tumblers, out of a hundred dozen, were broken in a full year of service at the La Rue Carter Hospital for mental health in Indianapolis.

They're "Crystalon" tumblers, made from BAKELITE C-11 Plastic—an improved, tougher, stronger material that drives breakage costs 'way down.

Their appearance is long-lived, too. They don't chip. Their crystal clarity is an inherent feature of BAKELITE C-11 Plastic. Their tapered shape is just right for stacking; light weight makes them easy to handle.

These tumblers can be washed in automatic dishwashers at temperatures as high as 180 degrees F. BAKELITE C-11 Plastic withstands contact with soaps, detergents, oils, food chemicals, coffee, tea, citrus peels, and cosmetics. "Crystalon" tumblers are made and distributed by International Molded Plastics, Inc., Cleveland, Ohio.

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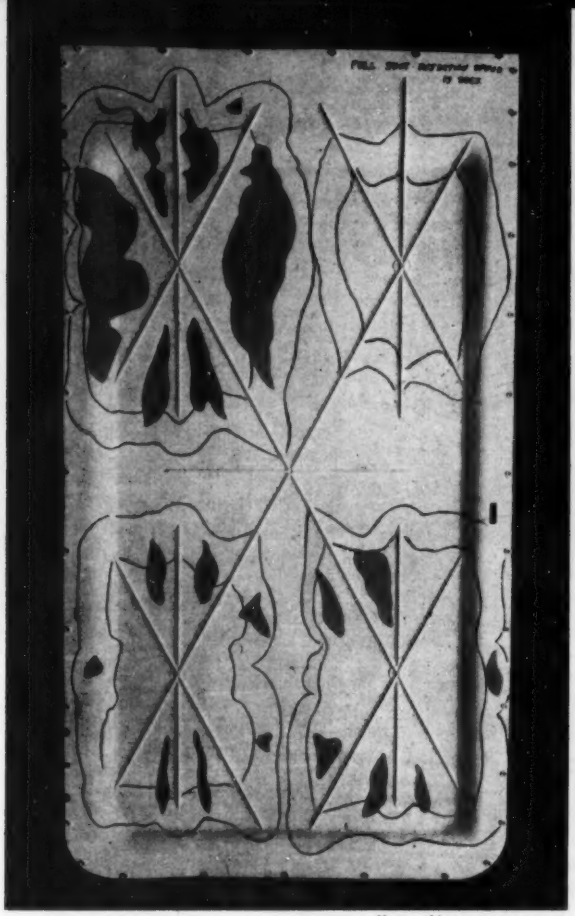
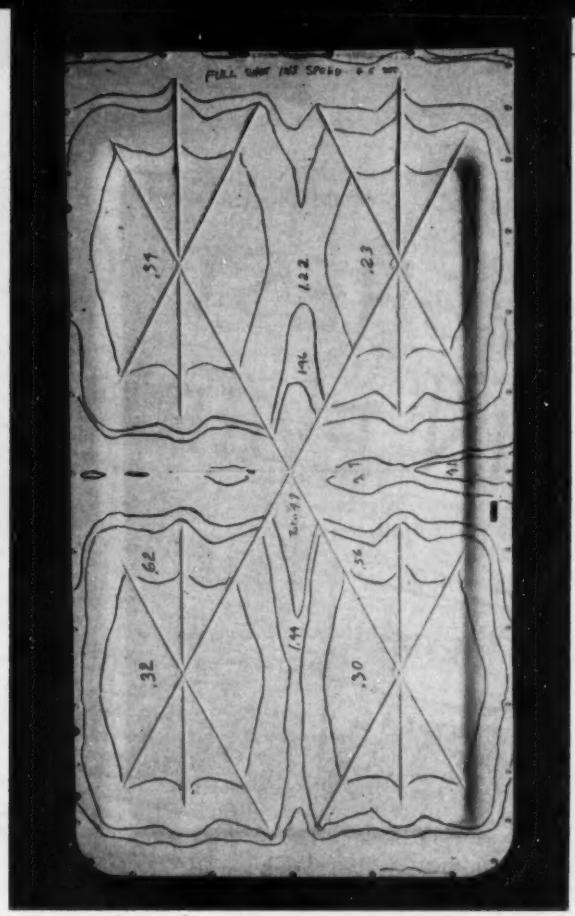




Photos this page courtesy Panelyte Div., St. Regis Paper Co.

Fig. 1—With injection speed at 17.5 sec. per shot, plastic flow is ragged and sink mark-like areas (in color) appear on the part

Fig. 2—Same panel, molded at full injection speed of 4.5 sec. per shot, exhibits no sink marks. Results of short shots are drawn in

erating at the highest possible injection speed fill more easily, have a more strain-free structure, and possess greater freedom from sink marks and weld lines.

There are many factors, other than the machine volume setting, which affect the speed of injection. Hydraulic pumps fall off markedly in volume output as the preset line pressure is exceeded during the injection part of the cycle. Any changes which will reduce the friction of the flowing material will permit the pump to operate at a lower pressure and, therefore, at a higher volume rate. Enlarging the runners and gates will reduce fluid friction and should be carried out as far as possible without interfering with other parts of the molding cycle, such as gate seal-off.

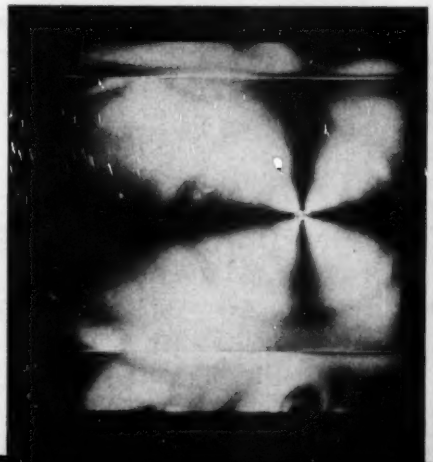
Fluid friction would be reduced if molding machines plasticized material more uniformly at higher temperatures on the short cycles permitted by thin-walled parts. This problem is a constant challenge to machine builders, and, while great strides have been made through the use of preplasticizing units, much improvement is still required. It has been found that many molding presses plasticize considerably below their rated capacity when making thin, large-area moldings.

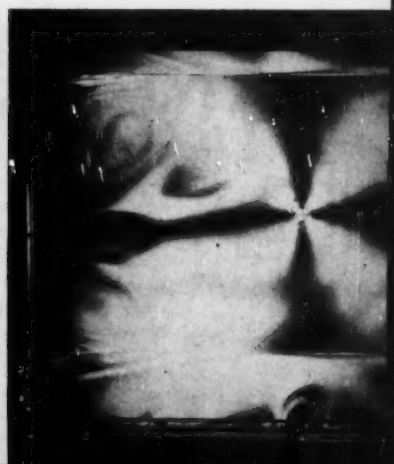
Material manufacturers could alleviate the flow problem if they could produce easier flowing molding powders without sacrificing physical properties. Materials would also be improved if it were possible to inject them at higher temperatures without running the danger of decomposition or loss of strength.

However, recognizing the fact that all of the above improvements would allow the machine to fill a given

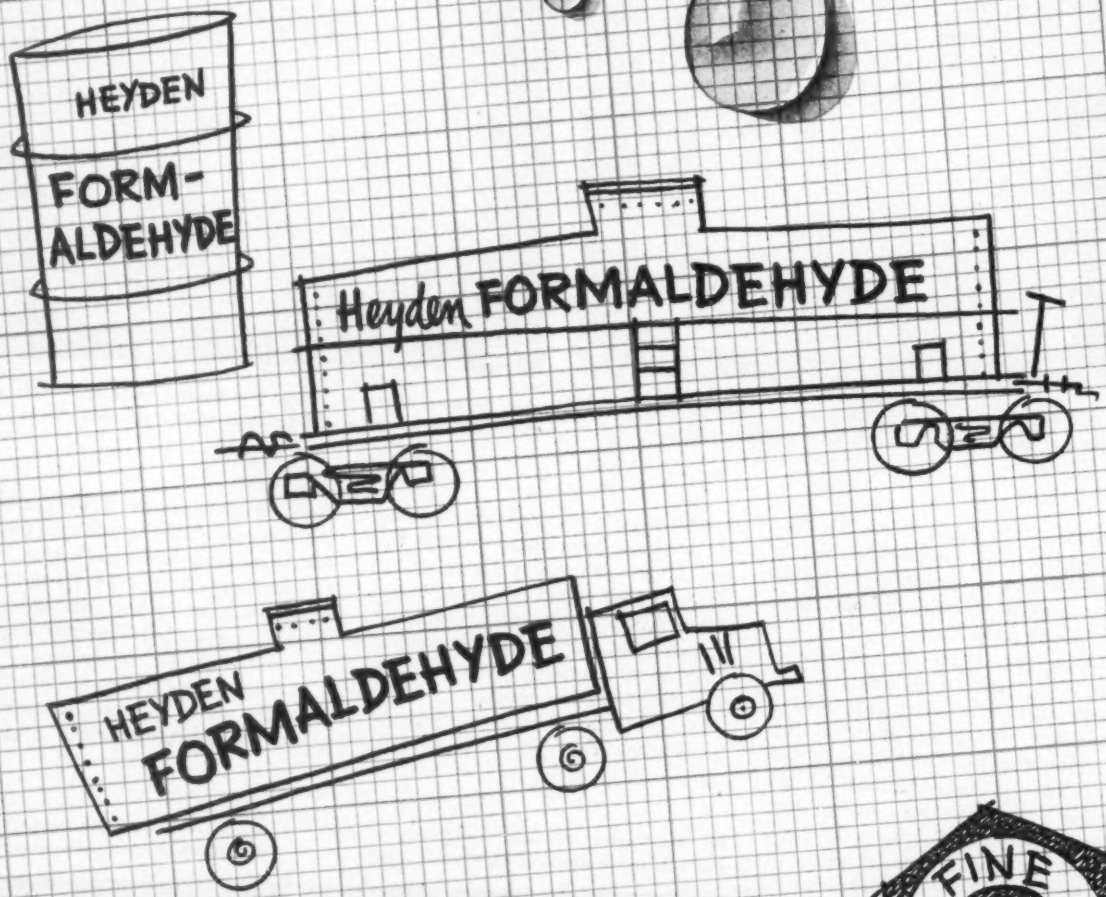
Fig. 3—Crossed Polaroids reveal only minor strains in part molded at high injection speed

Fig. 4—Part molded on same cycle at half the injection rate shows more strain





HIGHEST QUALITY IN EVERY DROP



IN ANY QUANTITY

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mold more quickly, the point would soon be reached where the mold fills as fast as maximum pump output dictates. This point has already been reached under certain conditions. It is obvious that the machine then needs a larger pump or perhaps an accumulator system to actuate the plunger at a higher rate of speed.

Early experience indicated that injection speed is an important variable in producing acceptable moldings of thin, large-area parts. In many cases, parts could not be filled until steps were taken to facilitate higher rates of injection. These steps included (after pump pressure and volume controls were set at maximum) increasing die temperatures, opening runners and gates, increasing material temperatures, and, as a final resort, lengthening the cycle to obtain more thoroughly plasticized material. Weigh-feeding devices have aided greatly in maintaining high speeds of injection by preventing choking of the heating

(Continued on p. 187)

Slush Molds and Molding

SLUSH molded items can be produced in the soft vinyls only; the process is not adaptable to the hard types. But since the production process is relatively simple, it offers a multitude of opportunities to explore new markets with a minimum of expense.

First step in production of a slush mold by electro-deposition is either a model or a drawing of the item. If a drawing is supplied by the customer, it is rendered into a model of plastoline. In either event, the finished model is used to produce a sectional plaster of paris mold. After the plaster is dry, the model is removed and a formulation of paraffin and carnauba wax is cast into the plaster mold. Plastic pieces from finished molds may also be used as models to produce slush casting copper molds.

The wax pattern or plastic part is first cleaned with methyl ethyl ketone to remove all traces of grease. Then a copper wire is attached to a non-critical area of the part to be plated. This will serve later as a conductor for the plating current.

Operator permits compounded plastisol to flow freely from fast-acting valve into mold below until it is full

Three preliminary steps are necessary before starting to build up the copper mold. First the pattern is immersed in a solution of 10% stannous chloride and 2% hydrochloric acid, which cleans the surface and provides a good acid base for sensitizing. Then it is removed and sprayed with a sensitizing solution of 225 g. of silver nitrate and 225 cc. of ammonium hydroxide in 2 gal. of water. After this sensitizing operation, the pattern is dried and then sprayed with a solution of 245 cc. of 45% formaldehyde in 1 gal. of water to prevent oxidation of the silver nitrate.

The final copper-plating process, which produces the finished mold, takes from three to seven days, depending upon the size of the mold, the plating process, and the thickness of the mold.

Filled mold is inverted over screened tank; plastisol continues to drip from molds as they move to first oven

Samples Molded

When electroforming of the mold has reached completion, the plated object is removed from the bath and the wax or plastic is melted out. After the interior of the mold has been thoroughly cleaned, several dozen samples are molded. From these it is possible to derive exact costs of raw material and labor; then an accurate quotation can be made without fear of overcharging the customer or incurring a loss.

No two slush molders operate in exactly the same way. However, a description of the methods used at Geneve Mfg. Corp. will serve as a guide to the design and operation of a basic slush molding set-up.

Photos courtesy Bakelite Co.

After passage through second oven, molds are cooled in spray bath; molds and pieces are dried by air blast

In the Geneve plant, the molds are all handled on conveyors. There are basically three stations on each production line—initial filling and dumping, second filling and dumping, and removal of the molded item.

At the first station, the mold is filled from a reservoir of plastisol through a fast-acting valve or spout and vibrated, agitated, placed under vacuum, or spun to remove all entrapped air. Experience has shown that the vibration method is the simplest and most easily adaptable to a custom-molding set-up where a variety of molds are in production.

After the mold is filled and en-

Courtesy Bakelite Co.

Masks are used in many spray painting operations on slush molded parts; decorative details are hand-applied

trapped air is removed, it is hung upside down on the conveyor line. The excess plastisol drains into a screened tank; the small amount that remains on the mold wall gels as the mold is carried by the conveyor into the first oven.

As the hot mold emerges from the first oven, it reaches the second operation station. Here the mold is removed from the conveyor, filled again with plastisol, vibrated to remove the air, dumped into another screened tank, and replaced in an inverted position on the conveyor which takes it to a second oven.

Wall Thickness

The key to final wall thickness is found in the temperature of the first oven. If that temperature is high, the mold will reach the second station while very hot. Then the plastisol charged into the mold at the second station will gel rapidly and, when the mold is dumped, a heavy wall of material will remain in the mold. Conversely, a lower temperature in the first oven will result in a cooler mold, less gelling of the plastisol at the second station, and hence a thinner wall section in the molded part.

From the second station, the conveyor takes the mold through the second oven, where cure is completed. As the mold emerges from this oven, it passes through a water chamber where a simple arrangement of shower heads sprays cooling water on the outside of the mold. From the water chamber, the mold is conveyed to the third station where the plastic bead on the edge of the copper mold is broken with a pair of small pliers. A jet of compressed air serves to release the piece from the mold and the piece is removed, again with the aid of the pliers. The empty mold is then returned to the starting point by a conveyor and is ready to begin the cycle once more.

Decoration

When slush-molded products are to be decorated, the paint must be chosen with care. Good vinyl lacquers are so formulated that, when properly sprayed, the resulting color cannot be rubbed off no matter how much friction is applied. This is accomplished by the use of biting solvents which penetrate into the cured plastic surface and carry the pigments with them. Paint spraying must be done at a 90° angle to the surface of the piece.

(MODERN PLASTICS, July 1953)

Restricted Gating

A SIGNIFICANT advance in the art of injection molding vinyl elastomers has been made with the proper application of restricted gating. This technique has been applied successfully to a laboratory knob mold and a color checker production mold at the Bound Brook plant of Bakelite Co., and a commercial four-cavity vacuum cleaner handle mold at George S. Scott Mfg. Co., Wallingford, Conn. The improvement is primarily in molded appearance, and principally in gloss.

The present stabilization art imposes a material temperature limit of about 350° F. at the nozzle for Vinylite elastomeric compounds. Travel through sprue and runners has a cooling effect so that material delivered to the cavity is somewhat below the temperature at the nozzle.

Until recently, it was customary to employ large gates, ⅛ in. in diameter and more, in mold design. The gates were often the same size as the runner. Such gates, naturally, contributed nothing toward increasing material temperature. Experimentation over the past three years has shown that the use of a restriction below 0.025 in. in diameter at or near the cavity entrance has a great effect on improving gloss. A reasonable explanation is that frictional heating occurs with a nearly instantaneous temperature rise which is sufficient to give the desired high gloss but is too short in time to cause discoloration or decomposition.

Heating of the material can be looked upon as a two-step process. The cylinder constitutes the first step and here the material should be heated to a level where the possibility of discoloration is remote but where fluidity is sufficient for machine operation. The second step is at the restriction where a final "flash" heat is obtained frictionally.

The first laboratory study at Bound Brook in applying restricted gating to a mold was carried on during the latter part of 1949. A two cavity knob mold which had been employed for several years in laboratory compound development work was used. A sketch of this mold with the large gate in existence at that time and with core pieces in position is shown in Fig. 1. View "A" is a cross-sectional view of the mold, "B" is a plan view of the sprue half.

The mold was adaptable to a study of the effect of gating since both gates were in removable pins ("R" in View A, Fig. 1) and gate changes were made by making new sets of pins. These pins were also runner stops; by rotating the pins the cavities could be closed off independently (Figs. 1 and 2 appear on p. 104).

Four Gating Systems

The runner stop pins made were based on the four different gating systems shown in Fig. 2 (mold surface views). System A was the type used at the beginning of this program. Runner and cavity entrance were both approximately ¼ in. full round. This system had never given pieces of uniformly high gloss except with the soft 60 durometer compounds, and there only with the smooth insert. Normally, molded pieces had dull areas on the surface.

System B was tried next. This consisted of a ⅜ in. full round runner tapering sharply over a 3/32-in. distance to a 0.015 in. full round

Well screen manufactured from Tenite butyrate by Southwest Well Screen Company, Jonesboro, Louisiana.

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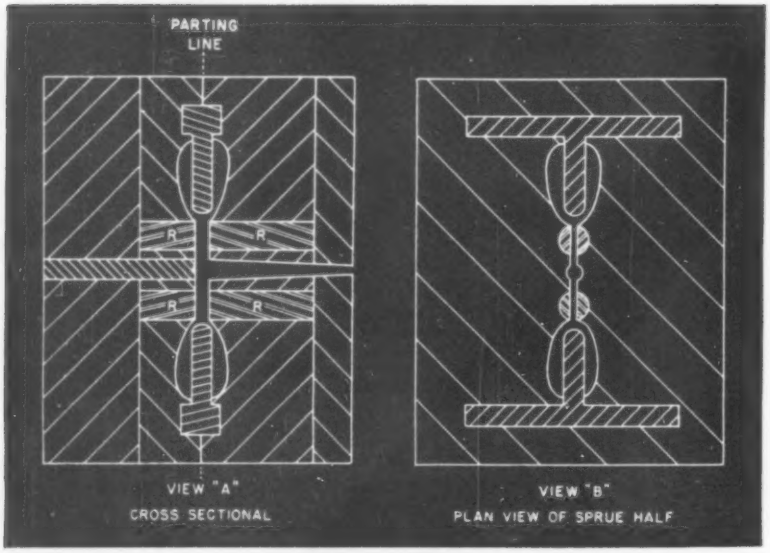


Fig. 1—Two-cavity, large gated knob mold, with removable core pieces in position

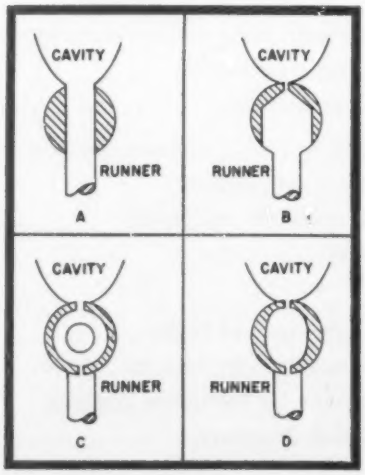
cavity entrance 1/16 in. long. With the smooth insert, this system produced pieces of good overall gloss but with severe "splash" marks on the surface. This particular insert gave a space of about 0.100 in. in the mold cavity between the tip of the insert and the gate, and the effect of reducing this distance was investigated. Use of a longer core piece, which brought the tip of the insert to within 0.020 in. of the gate, reduced the splash marks considerably. However, perfect pieces over the normal hardness range of 50 to 90 were not obtained with this system of gating, even though gate dimensions were varied.

System C was more successful. Here the restriction was moved back from the cavity, a pin was introduced in front of the restriction to produce annular flow, and a large entrance was used directly into the cavity. Satisfactory dimensions were 0.15 in. full round and 1/16 in. long for the restriction, a 3/16 in. round pin, and 1/8 in. round cavity entrance. The grooves around the pin were 1/8 in. full round runners. Pieces of good appearance and gloss were produced with this gate system from both smooth and threaded inserts, with the former somewhat better. The distance between the tip of the core piece and gate was not critical.

System D was also successful and even better than C. Here again the restriction was moved back from the cavity, and a well was used between the restriction and the actual cavity entrance. The restriction was 0.020 in. full round and 1/16 in. long, with the well 0.200 in. full round. The entrance into the cavity was 0.040 in. full round and 1/16 in. long. Here again the distance between the tip of the core piece and the gate was not critical.

The experience gained with the laboratory knob mold was next applied to an injection molding problem concerning the production of color checkers for sales purposes. Satisfactory color checkers could not be molded from Vinylite elastomeric compounds. The difficulty was primarily in obtaining a uniformly high gloss over the piece.

Fig. 2—Of four gating systems tried, C and D produced the best results



A two-cavity color checker mold was designed and built to explore the application of restricted gating to this problem. The parting line was straight down the middle of the edge of the piece.

This study showed, as did the work with the knob mold, that the use of a 0.015- by 1/16-in. restriction at the gate or in the runner near the gate develops high gloss with vinyl elastomeric compounds at molding temperatures well below the danger zone for this material. However, as in all mold design work, the production of unblemished pieces is dependent on gate location and dimensions.

An opportunity to apply laboratory experience on restricted gating to a commercial molding job was offered when George S. Scott Mfg. Co., undertook the production of vacuum cleaner body handles for the Electrolux Corp. The handle is approximately 8 1/2 in. long by 1 1/8 in.

(*Continued on p. 188*)

Reinforced Plastics Tooling

REINFORCED plastics have made possible the development of new tools for the automotive, aircraft, appliance, and other industries. As built by Renaud Plastics, Inc., Lansing, Mich., these include die spotting racks, checking and inspection fixtures, and welding and assembly fixtures, as well as multiple duplications, all made from original models.

All the tools are made up from wood models of sheet metal components, the wood model being used as a master. Basically, the operation consists of applying to the male model successive layers of glass cloth, each of which is impregnated with liquid resin before the next layer is laid up. This is continued until a thickness of approximately 1/8 in. has been obtained. First, however, before the glass cloth and liquid resin are applied, the model is coated with parting compound and wax for proper mold release.

After the resin has cured, a base is built for the plastics shell. Then the shell or mold is released from the model. As many duplications as

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FAST PLASTICIZING

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BRITISH MADE

SPECIFICATION

APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	6-9 in.
Maximum die space	7¼ in.
Minimum die space	3½ in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 x 10 in.

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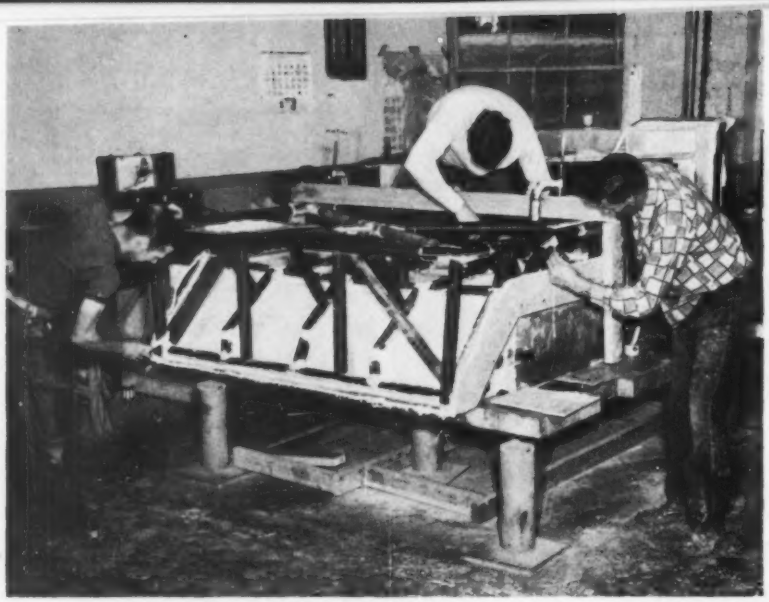


Base frame for checking fixture is built up of stock tubing and fittings

required can be made from this mold, for use in manufacture, assembly, quality control, and inspection. The same mold, mounted on a suitable framework, may also be used as a die spotting rack and feeler. Sight-check holes may be cut.

Reinforced plastics framework members used in building up base frames, including tubing, corners, T's, and centers, are stock Ren-ite items.

Welding Fixtures

A combination of a metal casting and reinforced plastics faces is being used in the production of various types of welding fixtures. The manufacturing procedure involves making a plastics mold from an original model. This first mold is reproduced and the reproduction is backed up and reinforced with plywood.

First step in the production of the final fixture is to lay up tailored layers of glass cloth on the reproduction mold. Each layer is thoroughly impregnated with liquid resin before the next layer of cloth is applied. After the reinforced plastics lay-up has cured, a bonding paste of resin and fibrous glass is smeared on the faces of both the cured laminate and the cast iron frame. The two are then set together, making sure that they are level and in perfect relation to each other. After the bonding layers have cured, the mold is removed, leaving the reinforced plastics securely bonded to the faces of the cast iron.

The accuracy of a welded assembly made with such a fixture depends entirely on the reinforced plastics faces of the fixture and not at all on the cast iron frame. By using such fixtures, uniform hoods and other parts are produced which aid greatly in assembling cars on a mass production basis.

In addition to welding fixtures, die spotting racks, etc., reinforced plastics fixtures are also used for quality control and inspection. A checking fixture for floor mats, for example, has been successfully built and used.

These are only a few specific examples of the use of reinforced plastics tooling for the automotive industry. It takes but little imagination to begin to visualize the extent to which these principles can be expanded in other industries in the future.

(MODERN PLASTICS, June 1953)

Injection Molding Rigid Vinyl

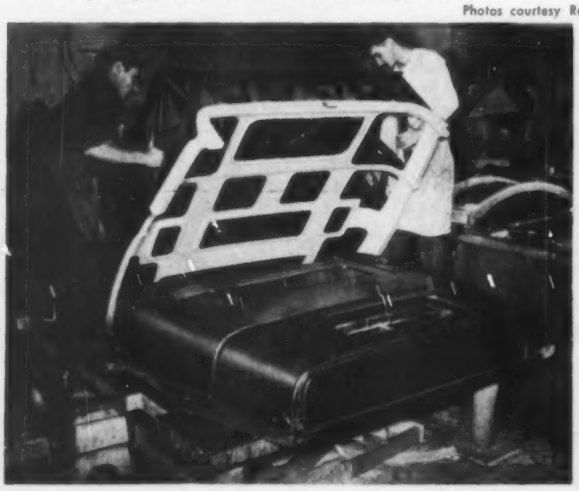
PROCESSING conditions for rigid or hard vinyls are most critical. Because of this, and because of the general lack of processing know-how, expansion of the rigid vinyl plastics market has been greatly handicapped.

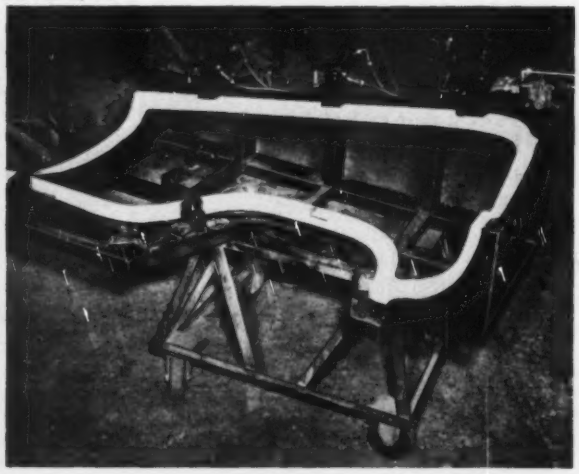
Several years ago, an injection machine was built which, although it was not realized at the time, would

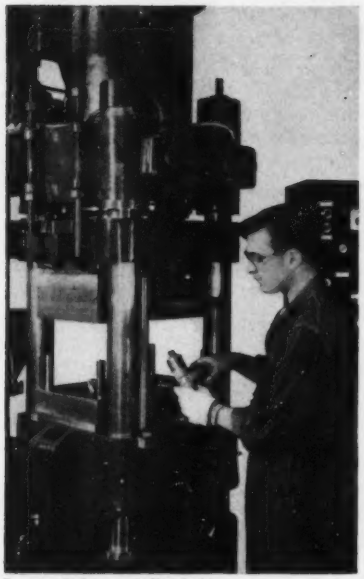
Finished spotting die rack is made of reinforced plastics

Fender welding fixture is molded on metal casting

Photos courtesy Renaud Plastics, Inc.







Courtesy Jackson and Church Co.
Injection molded rigid vinyl 1-in. "T" fitting is removed by operator from injection molding machine

eventually lead to injection molding of rigid vinyl pipe fittings at satisfactory production rates.

The original machine was built some years ago by Jackson and Church Co., incorporating the Hendry preplasticizing system which consists of an extruder-preplasticizer feeding into an injection chamber.

Later, realizing the need for injection-molded rigid vinyl parts, the machinery manufacturer designed, on the same principle, a machine specifically for this work. It comprises three elements: A horizontal extruder feeds into a vertical injection chamber which in turn feeds fully plasticized material into a vertically clamped mold.

Extending from the hopper to the injection chamber of the machine, the screw operates at any desired speed to mull the plastics material prior to injection. The result of this is a thorough mixing and heating, allowing the material to be injected into the mold at more constant temperatures and lower pressures.

After being extruded into the injection chamber by the screw, the constant viscosity material is shot into the mold by a hydraulically operated ram. Clamping of the mold is by hydraulic action only and involves no toggle joints or levers.

Using a two-cavity mold for a 1-in. "T" pipe fitting as an example, the over-all cycle time is 2 min., broken down as follows: Slightly less than 1 sec. for injection, hold time 15 sec., and cooling time 85 seconds. The balance of the cycle time is consumed in opening the mold, removing the fittings and threaded mold insert parts, placing in the mold a second set of removable threaded mold parts, and closing the mold.

This development in molding equipment and techniques may well be the cause of another plastics expansion cycle such as occurred with the introduction of calendered film. With molded parts now available, new large-volume applications may well be found which will enable rigid vinyls to compete in markets presently considered to be outside the plastics field.

(MODERN PLASTICS, December 1953)

Techniques of Vacuum Forming

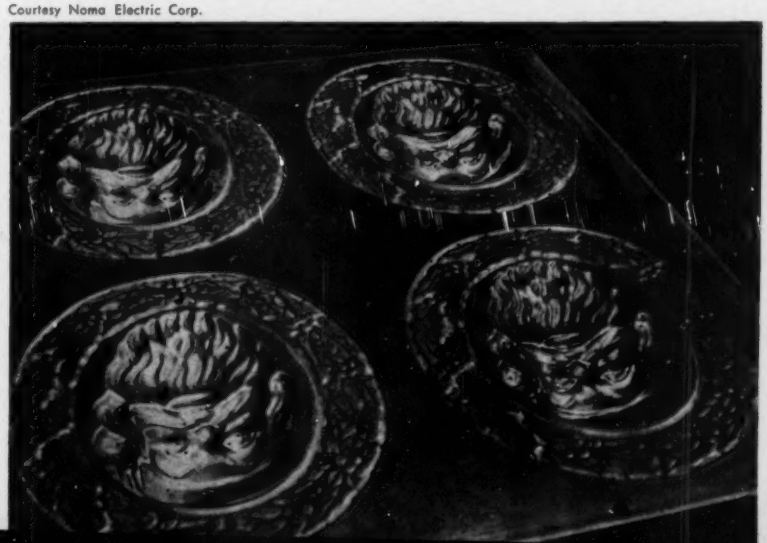
VACUUM forming, with overall cycle times as low as 30 sec., has taken its place along with other high speed plastics molding operations. With continuing improvements in heater design, mold cooling, and handling methods, there is little doubt that cycle times will come down to as low as 15 seconds. Can vacuum forming compete with injection molding? The answer is a qualified "yes;" the qualification involves limitations of piece design. Some parts being injection molded today can be vacuum formed at lower piece prices and at much lower mold costs. For example, a large company is now vacuum forming a part which was previously injection molded. This part is a 30 in. high Santa Claus which was previously injection molded of styrene and subsequently hand decorated. The injection mold cost $16,000 and the necessary spray masks another $2000 or a total of $18,000 for tooling. The same part now being vacuum formed of "decorated in the flat" rigid vinyl sheet stock necessitated a tooling expenditure of less than $1000 for the vacuum mold, silk screens, original art work, and cutting dies. This indicates a saving of approximately $17,000 in tooling cost. The unpainted styrene injection molded parts cost $2.00 each and an additional 17¢ was required for decorating. The vacuum formed parts cost less than $1.00 each with no additional cost for decorating.

Advantages

One great advantage of the vacuum forming method is that it makes possible multi-color decoration at very low cost, since the decorating can be done on the flat sheet before it is formed. In this process, coloring is applied to the flat sheet in a distorted design such that, when the sheet is drawn to shape, the colors will accurately fall into their assigned places.

Colors are applied to the flat sheet by either silk screening or printing by one of the various printing proc-

Close-up of finished sprayed metal mold, after backing up and drilling of vacuum holes. In some molds, pins placed in the master are later removed to produce the vacuum holes
Courtesy Noma Electric Corp.



Courtesy Noma Electric Corp.

One big advantage of vacuum forming is that decorations can be applied to the flat sheet in distortion (foreground) and will fall into place after sheet is formed (background)

esses, of which lithography is most commonly used. An area as great as 8 to 10 sq. ft. can be precolored at one time in as many colors as required and then vacuum drawn. Molds with numerous cavities can be used to form sheets of this size and the individual pieces die cut, thus producing many parts per cycle of the machine.

Even the most complicated molds for vacuum forming are relatively inexpensive since the majority of them are either made of treated plaster or are reinforced sprayed-metal or electro-formed shells.

Plaster molds are made of the harder plasters such as U.S. Gypsum's Hydrocal or Certainteed Products' Densite. These plasters are usually reinforced with screening. The cost of such molds is about $30 to $40 per sq. ft. exclusive of master cast, with about $20 per sq. ft. additional cost for a clamping frame.

Sprayed metal molds are practically permanent molds; many of this type now in service have produced 500,000 pieces and are still in good shape. Such molds are made by spraying hot metal particles on a master and building a durable shell having a thickness of ⅛ to 5/16 inch. This shell, backed up to strengthen the assembly against the shock of vacuum forming, is then drilled with vacuum holes and is ready for use. Approximate costs are as follows: spraying, $75 per sq. ft.; backing up, $15 per sq. ft.; clamping frame, $20 per sq. ft.

Mold masters are prepared of plastic, wood, plaster, or rubber. For the best mold, a low shrinkage lead compound is first sprayed on the master to a thickness of approximately 0.005 to 0.020 inch. This is then backed up by many coats of a bronze compound until the shell has reached the desired thickness. The larger the mold, of course, the thicker the required wall section.

Molding

The molding operation consists of placing the plain or preprinted sheet of material, cut to proper size, over the mold. A clamping ring is then lowered into place and totally clamped so that air cannot leak between the thermoplastic sheet and the top surface of the mold. The heater element is then pulled into position over the sheet. After a predetermined length of heating time has elapsed, the valve to the vacuum pump or chamber is turned on. Pulling the vacuum causes the softened sheet to be forced into the mold by atmospheric pressure pressing on the outer surface of the sheet. After a short cooling period, the clamping ring is removed and the formed sheet taken out of the mold.

Cutting out the formed pieces from the sheet is accomplished with dinking machines, clickers, or crank presses and the use of high dies.

A high die is placed atop the work and a swinging head is pulled over the die. A quick short stroke of about 1 in. is imparted to the die, forcing it through the work. The head is then swung out of the way and the pieces removed. A dinking machine works on the same principle except the head does not swing; the work and die are slid under the head. Usually several pieces are stacked and cut to shape in one operation.

Dies cost from $75 to $300 and will last for hundreds of thousands of pieces. Parts having an area of about 1 sq. ft. average can be cut at a rate of from 1000 to 1500 pieces per hour in thin gages.

(MODERN PLASTICS, May 1953)

Engineering Nylon Gears

NYLON gears for the automotive industry came of age with the introduction, by Packard Motor Car Co., of the first all-nylon gear train in their Ultramatic Drive transmission for their 1953 models.

Nylon gears run together silently without the noise concomitant with metal gears. This characteristic is extremely important because it eliminates the necessity of adhering to the close dimensional tolerances which are necessary with metal gears to reduce mechanical vibration. Extensive wear tests have proved that nylon stands up well.

The procedure adopted at the beginning of the Packard gear program involved building of production molds with cavities that would produce the part minus the teeth. Shrinkage data obtained from these sample parts were utilized in determining the proper mold shrinkage factor for dimensioning the cavities and cores.

One cavity of each part was then machined and installed in the production mold bases. This one cavity and the three blank cavities were run to produce the initial gears. The

Four-cavity production mold for nylon transmission speedometer driving gear, in open position, with the operator removing one gear and its core pin from the mold

first sample gears were at considerable dimensional variance with print dimensions and lead and involute charts yielded results which, to those familiar with the usual standards of fine gear manufacture, would be considered extremely poor.

Since the dimensions varied so greatly from the print it was decided to proceed with new cavities, utilizing the sample gear cavities as guides to correct for incorrect dimensions. The original samples were road tested at the Packard Proving Grounds, and, amazingly enough, ran for 48,463 miles without showing signs of wear, despite the obvious errors in dimensions.

The final production molds produced gears that maintained pitch diameter runout within 0.002 in. F.I.R. and kept parallel surfaces running true within 0.0015 in. F.I.R. Extreme care in mold building was required; all holes embodied in the entire die bases were jig bored and jig ground to insure the accuracy required.

Several observations regarding mold shrinkage of nylon can be drawn from this work. In general, it has been found that the base circle from which the involutes are generated shrinks in an approximate proportion to other diametral changes. So, too, the lead or helix changes seem to be in a fairly predictable pattern once molding conditions have been stabilized and shrinkage established. The amount of change in the tooth profile—called pressure angle—is in approximate proportion to diametral shrinkage of the molded piece.

If any general conclusions as regards accuracy required in nylon gears can be drawn, they might be that: 1) involutes with modified tips seem to perform better, 2) the horny flexibility or resiliency of nylon will permit much greater variation in dimensions than is permissible in steel yet still give good service life, and 3) the limits of tolerance on nylon gears for the usage described could be more correctly specified in thousandths rather than in ten-thousandths common to metal gear manufacture without serious detriment to service life, provided back-lash in service use is not a critical factor in the application being considered.

Though it does not appear possible to obtain accuracies in nylon gears equivalent to those obtained in the precision machining of metals, the molded product if properly controlled in its manufacture, will out-perform its precision metal counterpart on the following points: a) quietness of operation, b) length of service life, and c) cost of manufacture.

(MODERN PLASTICS, September 1953)

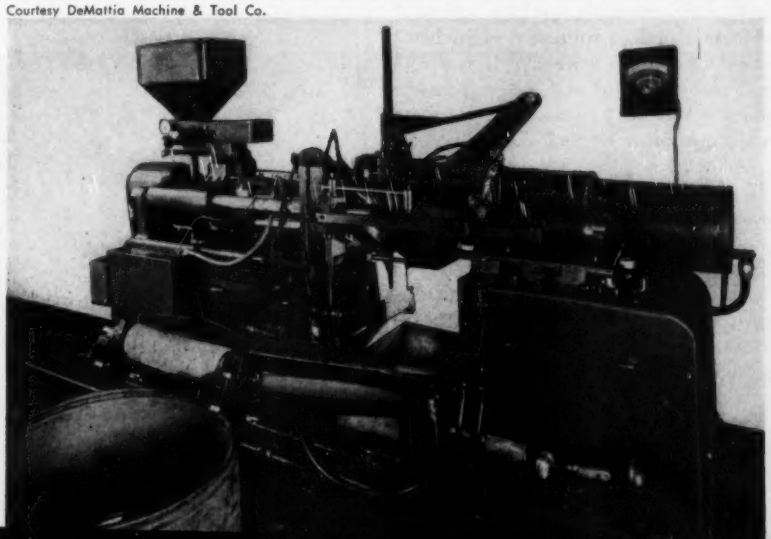
Universal Injection Machine

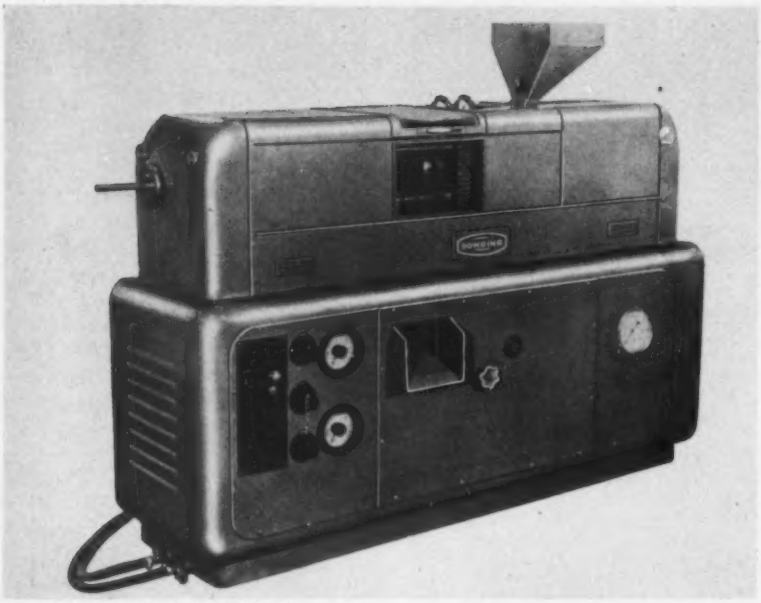
RECENT addition to the family of injection molding machines being produced by DeMattia Machine & Tool Co., Clifton, N.J., is the 3-oz. Model "K" universal, fully automatic machine. The Model "K" features a straight-line hydraulic clamp with a built-in intensifier that increases 1000 p.s.i. pressure to 5300 p.s.i. on the mold closing ram.

The operation of all movement is fully hydraulic, including the snubbing and stopping of the die closing platen. Automatic feeding is made possible by means of a starved weight material feeding device and

Universal injection machine, with all automatic features, running 2-cavity lamp shade mold

Courtesy DeMattia Machine & Tool Co.





Illustrations courtesy Dowding and Doll Ltd.

Over-all view of new injection molding machine in which injection end has been designed to incorporate a combination preplasticizer and injection cylinder

the company has also developed and will supply at additional cost, a number of devices which greatly aid in making automatic molding 100% efficient under every condition. These include a mechanical brush-off arrangement to remove pieces stuck on ejector pins.

(MODERN PLASTICS, June 1953)

Unique Spreader Design

PLACED on the market by Dowding & Doll Ltd., London, England, a 1- to 2-oz. high speed fully automatic injection machine has an injection end of unique design. Instead of a male spreader it makes use of what might be called a female spreader in that slots are machined on the interior wall of the cylinder.

A metal sleeve, known as a "prefill ring," is assembled on the rear end of the injection ram. The interior wall of the cylinder toward the rear does not have machined slots as the front end does, but instead, is round and smooth, having an I.D. equal to the O.D. of the prefill ring plus some clearance.

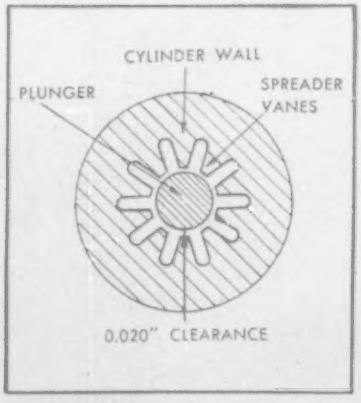
This ring, hydraulically operated, rides backward and forward on the rear section of the machine's injection ram.

When the ring is in the retracted position, the port between the material hopper and injection cylinder is open and molding material falls into the cylinder. The ring then moves forward. The material ahead of the ring is forced through the spreader slots and thence into the front end of the injection cylinder, forcing the injection ram backward.

With this setup, all the material ahead of the injection ram is fully plasticized. With the prefill ring locked in its fully forward position, pressure is applied to the injection ram, forcing plasticized material through the nozzle into the closed mold. The prefill ring then returns to clear the feed port so that another charge of material can enter the cylinder. A hydraulically actuated toggle opens, closes, and clamps the mold, which can have a maximum molding area of 15 sq. inches.

(MODERN PLASTICS, June 1953)

Machined slots form spreader vanes



Single Stage Preplasticizer

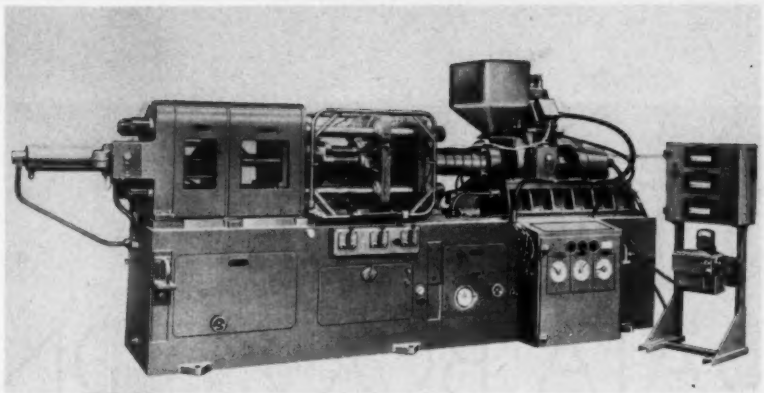
A NEW preplasticizing injection molding machine was introduced by R. H. Windsor Ltd., Leatherhead Road, South Chessington, Surrey, England. It is known as the A.P. 1044 Autoplas single stage multi-screw preplasticizer unit.

The new machine presents for the first time a single stage "in-line" system of preplasticizing. The incorporation of this unit into the Windsor SH 8-10 oz. injection molding machine enables 32-oz. moldings to be made, whereas the previous maximum capacity of the machine was only 10 ounces. Plasticizing capacity, which formerly was about 60 lb. is now raised to about 140 pounds.

The novel injection plunger consists of two specially designed intermeshing screws which are driven by a fluid motor through a gear box. The fluid motor, gear box, and screw assembly slide forward and backward as an independent unit. The material is fed to a heated stationary barrel, in which the screws rotate and press the plastic mass forward, plasticizing it under high pressure, to the front of the barrel.

Injection is accomplished by a hydraulic ram, the cylinder of which is fixed at the far end of the frame. The ram moves the screws (which do not rotate during injection) forward through the barrel towards the nozzle, expelling the preplasticized material into the mold.

When the mold is filled, the fluid motor starts and the screws resume rotation, pressing the plasticized material forward and filling the front of the barrel. Since the mold is already filled, pressure is built up in



Courtesy R. H. Windsor, Ltd.

Over-all view of new injection machine with a screw-type preplasticizer

front of the screws, causing the screws, gear box, fluid motor assembly, and the hydraulic ram to move backward to a predetermined stop. The return movement can be arrested at any point of the stroke. During this movement, cooling of the molded component has taken place and it can be removed. The mold is then closed and the cycle begins again.

(MODERN PLASTICS, September 1953)

Automatic Sheet Forming

NUMEROUS objects such as packages, lighting fixtures, displays, and other items are now being formed from thermoplastic sheet on a fully automatic basis by Plaxall Inc., Long Island City, N.Y. That company is operating under a license arrangement from Design Center, Inc., owners of patents on the machinery and the process. Although some variation in the molding process exists according to the size, shape, and depth of draw required, the basic techniques are essentially the same for all of the products being made.

The molding operation proceeds along the following general lines: Acetate sheet stock is fed from a roll by chain conveyor through all the forming operations. A section of predetermined length is first drawn over an electrical heater where it is permitted to remain for approximately 10 seconds. The heater is so constructed that it will heat the exact area of sheet required for the part or parts which are about to be formed.

Recommended temperature of the sheet as it is drawn under the die is from 220 to 250° F. The female mold is held at a temperature of 130° F. by a thermostatically controlled circulating coolant. The heated sheet is then fed under a forming die mounted under the head of a downward operating air-operated forming press.

On the bed of the press is a clamping ring so designed that when the female die is lowered on top of the sheet the edges of the sheet are clamped air-tight between the die and ring. A port in the center of the bed of the press is connected through electrically operated air valves to a source of compressed air. The female mold is designed with small ports or openings which in turn are connected through other electrically activated valves to a source of vacuum.

Pressure and Vacuum

After the heated sheet has been indexed in its proper position on top of the clamping ring and beneath the female die, a valve is automatically opened to admit air pressure to air cylinders which raise and lower the female die. After the die is clamped against the sheet, air pressure is admitted under the sheet, forcing the softened sheet upward into the die. At the same time, air is evacuated from the die so that the sheet will be pressed uniformly against the die.

The actual forming operation is completed in a fraction of a second, but approximately 8 to 10 sec. are required for the formed sheet to cool and become rigid. The die itself, of course, is cored for circulation of a cooling medium to expedite cooling of the sheet stock. At the end of the cooling period, the die opens and the conveyor indexes forward,

(*Continued on p. 114*)

Sheet is automatically indexed over heater in foreground, then under forming mold. Mold is closed and clamped by means of air cylinder

Ejection side of sheet forming press. Parting line of the formed pieces has been deeply scored so that they can be snapped from the web

Courtesy Plaxall Inc.

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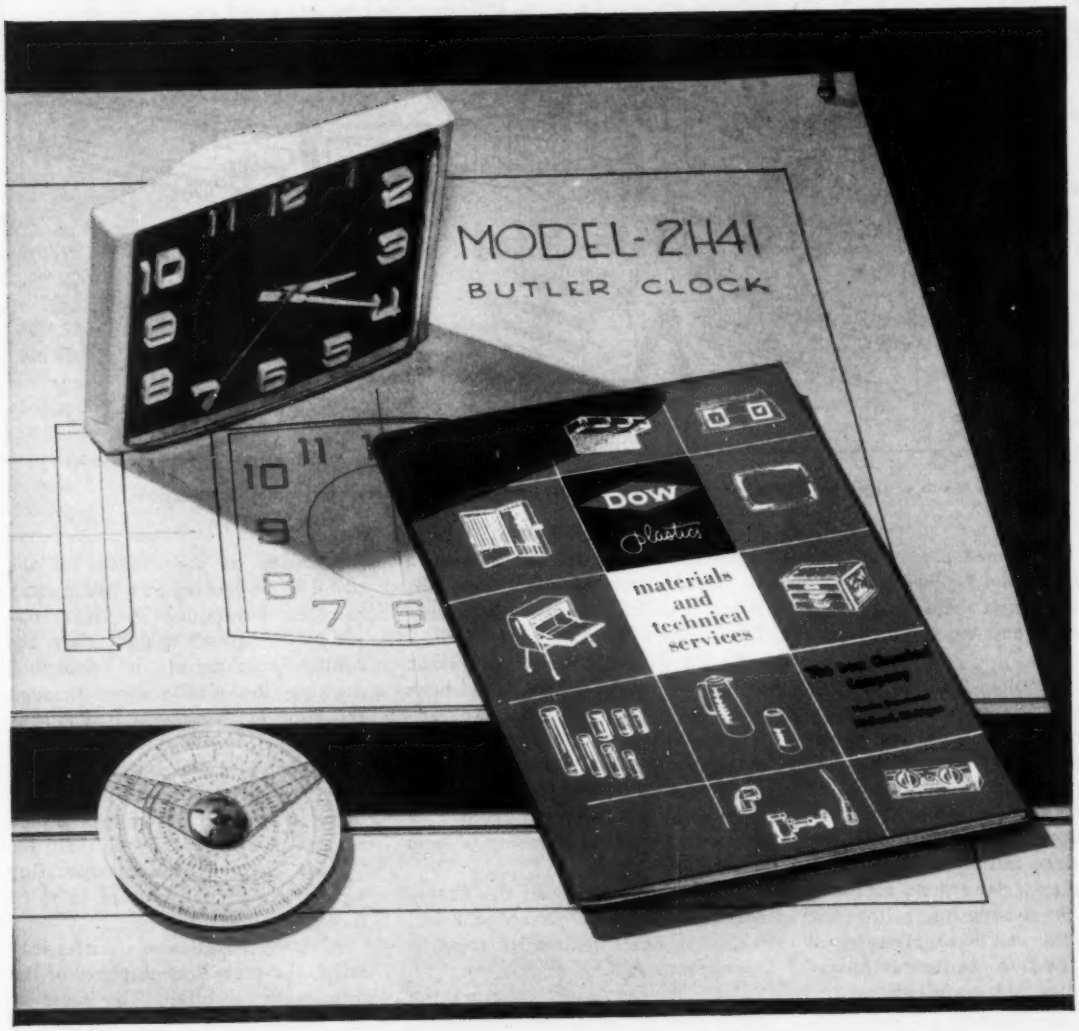

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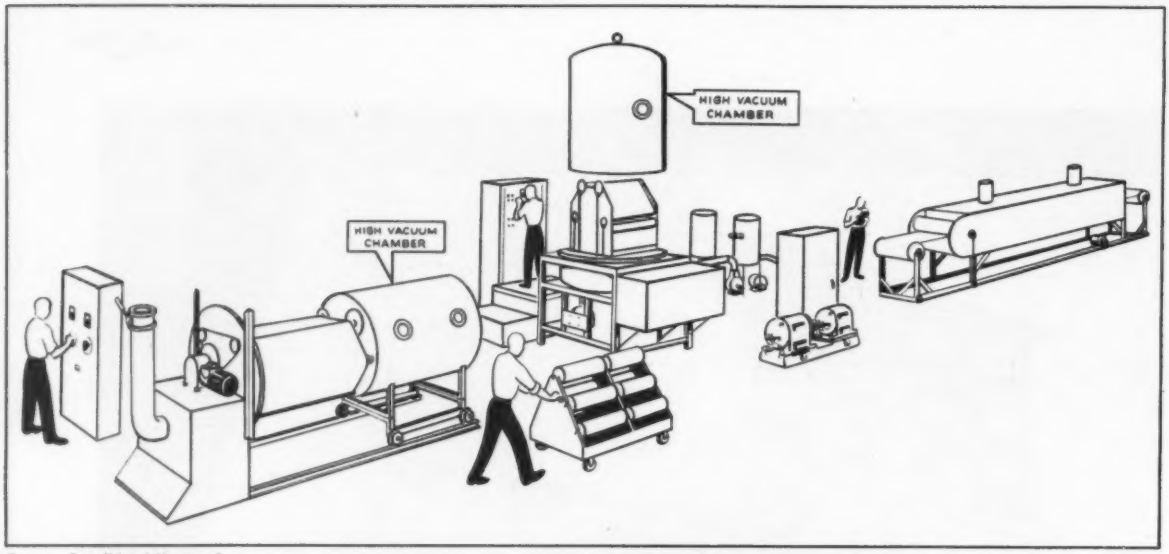

Courtesy Consolidated Vacuum Corp.

Process sketch of sheet metallizing operation shows degasser (left), roll coater (center), and lacquer coater (right)

carrying the formed piece out from under the die and replacing it with a heated section of sheet stock. Then the die closes and the forming cycle is repeated.

An interesting feature of this process, which aids greatly in making it fully automatic, is that, as the cooling cycle approaches its completion, a cutting edge engineered to the exact shape of the parting line of the finished piece is forced downward against the sheet stock. This scores the material around the periphery of the parting line so that the formed pieces can be simply snapped out from the web. No further finishing or trimming is required.

(MODERN PLASTICS, July 1953)

Vacuum Metallizing Of Sheet

HIGH vacuum is making it possible to apply a thin but highly reflective and long-lasting coating of metal to various kinds of plastic sheet material quickly, easily, and economically.

Acetate and styrene sheet are used most frequently as bases for the metal coating; each material has advantages and disadvantages. Styrene requires less preparation before the coating operation since it contains less residual plasticizer or solvent, whereas acetate is favored by some users because, they say, it has a glossier surface and therefore yields a more brilliant finish.

In the first operation, the plastic sheeting is continuously rolled back and forth under a vacuum of approximately a half-millionth of atmospheric pressure until all volatiles have been removed. Maintenance of vacuum is the accepted method of determining when degassing process is complete.

With acetate material, the degassing period usually is about 3 hr., while styrene ordinarily requires approximately 1 hr. or less.

After the degassing operation, the roll of plastic sheeting is transferred to the vacuum coating unit.

When the desired vacuum has been produced, high-frequency (9600 cycles) current is applied to induction coils surrounding a number of graphite crucibles, each containing several ounces of type 25 aluminum. In 5 to 10 min. the aluminum becomes molten and begins to vaporize quite rapidly, with the vapor disseminating in straight lines from the molten source and condensing on the first surface it touches. The crucibles are positioned about 10 in. below the plastic sheet, in order to produce a film of uniform thickness across the full width of the material. For 26 in. wide material, three crucibles are required; narrower sheets can be coated with only two crucibles.

As soon as vaporization of the metal is proceeding at a satisfactory rate, as determined by visual observation through a sight glass, the rolling mechanism is activated, drawing the plastic sheet through the zone of vaporization at a constant speed. The thickness of the film of condensed metal is controlled by varying the speed with which the material is rolled. That may be set at any speed between 15 and 100 ft. per minute. Normal operating speeds usually range from 40 to 60 ft. per minute.

In the preparation of transfer material, the metallization phase of the process is essentially the same as for the acetate or styrene mentioned above. However, the sheet preparation step is quite different in that a wax material, which will melt when heat is applied, must be added prior to metallization. This wax serves to release the metal film from the plastic base, thus making the transfer possible.

The final step in the preparation of the transfer material is the coating of the metallized plastic with a bonding agent or cement. This cement is essential to bond the metal film to the receiving object.

Transfer materials of gold, silver, and aluminum are currently being marketed for such applications as book lettering and for metal coating of cloth, shoe leather and synthetic shoe materials.

(MODERN PLASTICS, December 1953)

Machines for Thermoplastics

IN THE report on machines for thermoplastics published in the January 1953 issue, it was predicted that 1953 should be a better year for the machinery builders than 1952. This statement was made despite the fact that injection machine shipments for 1952 were approximately 35% over those for 1951, and extrusion machine shipments were approximately the same, although in both 1951 and 1952 shipments of extrusion machines were 50% higher than in 1950.

The prediction became fact. Injection machine shipments for 1953 were 55% greater than those in 1952; and extrusion machine shipments for the same year were up by 12½% over 1952. These percentages pertain to domestic shipments of machinery. For exports, see tabulations in last column on this page.

Machines in Use and Delivered

	1948	1949	1950	1951	1952	1953
Injection Machines						
Machines in the Industry	4102	4814	5683	6251	7015	8204
Machines Delivered in Year		712	869	568	764	1189
Extrusion Machines						
Machines in the Industry	1641	1987	2307	2792	3279	3828
Machines Delivered in Year		346	320	485	487	549

In the injection machine field, every size group showed a substantial increase with the exception of "up to 2½ oz." which was exactly the same as in 1952, as shown in the first tabulation in the last column, this page.

There was an increase of 80 machines in the 3 to 6 oz. classification; 139 in 8 to 10 oz.; 167 in 12 to 16 oz.; 9 in 20 to 28 oz.; 13 in 30 to 32 oz.; 11 in 40 to 50 oz.; and 6 in the 60 oz. and over classification.

In discussing this sizable bulge in injection machine shipments, the sales manager of one of the larger injection machine manufacturers made the following impressive statement: "There is every indication that 1954 will be as good as, if not better than, 1953." When asked for a basis for this statement, the reply was: "I predicted last year that 1953 would be by far the best year we have ever had and based that statement on our backlog of orders; today our backlog is just as good as, if not better than, it was a year ago."

Another manufacturer of injection machines is very optimistic about increasing his 1954 sales because of the addition to his line of a fully automatic machine.

Although tabulated figures of injection machines do not include so-called "custom built" machines in the industry, an informal survey indicates that approximately 50 more machines were added in this category during 1953. This would bring the estimated figure for machines of this type to a total of between 550 and 650.

For several years it has been impractical to tabulate accurately the sales of compression presses. A conservative estimate, however, based on discussions with molders and machinery manufacturers, placed the number of compression presses in the industry at approximately 15,000.

Domestic shipments of injection machines for both 1952 and 1953, broken down according to capacity, were as follows:

Capacity (oz.)	*Number shipped 1952*	*1953*
Up to 2½	231	231
3-4-6	249	329
8-9-10	111	250
12-16	107	274
20-24-28	31	40
30-32	16	29
48-50	10	21
60 and over	9	15

Domestic shipments of extrusion machines (including twin screw types) for 1952 and 1953, broken down according to screw diameters, were as follows:

Screw size (in.)	*Number shipped 1952*	*1953*
Up to 1½	90	101
2-3	177	207
3-4	119	136
4 and over	101	105

Export shipments of injection machines for 1952 and 1953 were:

Capacity (oz.)	*Number shipped 1952*	*1953*
Up to 2½	33	33
3-4-6	28	14
8-9-10	36	42
12-16	2	15
20-24-28		2
30-32		1
48-50		2

Export shipments of extrusion machines for 1952 and 1953, broken down into sizes according to screw diameters, were as follows:

Screw size (in.)	*Number shipped 1952*	*1953*
Up to 1½	17	22
2-3	58	37
3-4	46	20
4-8	16	12

400

Marblette Resin #400. Wood coating resin—hardest known to man!—resistant to chemicals, solvents, and temperature extremes. Sets at room temperature. Dries to touch in 45 minutes; dries hard within six hours. Excellent dimentional stability. Recommended for industrial wood surfaces, foundry patterns, shoe lasts, hat blocks, etc.

51

Marblette Resin #51. For bonding plastics to plastics, plastics to wood, plastics to fabrics, wood to wood, etc. Mixed with hardener, sets at room temperature overnight. Transparent or opaque.

71

Marblette Resin #71. Dimensionally stable, quick curing heat set resin with 12 hour pot life and 4 month shelf life. Used in making stretch dies, tools, drill jigs, assembly jigs, forming blocks, foundry parts and match plates. Low viscosity insures excellent detail. Craze resistant. Light fast. Ivory colored.

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The Year 1953 in Review

THE 1953 Nobel prize in chemistry was awarded to a pioneer in the field of high polymers, Dr. Hermann Staudinger, Director of the Institute for Macromolecular Chemistry at Freiburg, Germany. Dr. Staudinger broke with tradition in the early twenties by proposing that rubber, cellulose, and starch are actually large molecules held together by true valence bonds in long chains and not simple aggregates of small molecules held together by secondary forces. He used synthetic resins prepared from simple monomers, such as styrene and acrylic acid, to prove this thesis and to show that both natural and synthetic polymers are built up in accordance with the fundamental reactions of organic chemistry. Another significant contribution was his discovery that the specific viscosity of a polymer solution is proportional to the molecular weight; this rule has provided an extremely valuable tool for the evaluation and production control of synthetic resins. The plastics industry has good reason to applaud the decision which recognized the outstanding contributions of Dr. Staudinger to its development (1).[1]

Atomic Energy

Pioneering work in 1953 saw the fast-moving atomic energy developments applied to produce useful changes in the physical properties of long chain polymers (2-4). Polyethylene irradiated in an atomic pile for a short period becomes cross-linked and withstands temperatures up to 250° C., whereas the melting point of the ordinary polymer is approximately 115° C. General Electric Co. has achieved the same result by the use of gamma radiation from a modified million-volt X-ray machine; a few seconds' bombardment renders polyethylene bottles capable of withstanding steam sterilization. Nylon, polystyrene, polyvinyl alcohol, polyvinyl chloride, and polyethylene glycol have all been cross-linked by pile irradiation. Polytetrafluoroethylene decomposes by chain scission under similar treatment; polyisobutylene is converted to a viscous liquid. Many constructive applications of atomic and electron beam energy in the plastics field can be expected when these research and engineering studies have progressed further.

Table I—Annual Production and Per Capita Consumption of Plastics in the Western Countries

Country	Production 1948.	Production 1953	Capacity by 1955	Per capita 1953	Per capita 1955
	10^3 tons	*10^3 tons*	*10^3 tons*	*kg.*	*kg.*
U. S. A.	713	1200	2000	7.5	12.5
Western Germany	48	225	315	4.5	6.25
Great Britain	121	195	265	3.9	5.4
France	34	53	85	–	2
Italy	9	25	45	–	0.8
Total	980	1950	2710		

Statistics (Table I) on the production of plastics in the Western countries provide evidence of the worldwide growth of this industry during the past five years as well as the significant position of the United States with respect to acceptance of plastics products by the public (5). Comparative figures on exports of plastics materials from the United States, Great Britain, and Western Germany in 1952 and estimated figures for 1953 are given in Table II, page 118 (6).

The importance of this world trade in plastics to the American industry calls for continuing and increasing participation in the efforts of the International Organization for Standardization (I.S.O.) to provide

Reinforced plastics tanks find wide use, are not affected by most chemicals
Courtesy American Cyanamid Co.

* Reg. U. S. Pat. Off.
[1] Numbers in parentheses link to references starting on p. 132.

clearly defined terminology and international standard methods of test.

The third meeting of the I.S.O./T.C. 61 Committee on Plastics was held in Stockholm on August 10-14, with G. M. Kline (U.S.) and H. Liander (Sweden) presiding as co-chairmen and twelve countries represented. The American delegation consisted of six members: R. Burns (Bell Telephone Laboratories, leader); R. Buchdahl (Monsanto); F. W. Busse (DuPont); G. M. Kline (National Bureau of Standards); R. Witt (NEMA); and E. Y. Wolford (Koppers). Six Draft Proposals of testing methods were prepared by the I.S.O. Committee at the Stockholm meeting for circulation to the participating member bodies (13 countries) for approval as recommended I.S.O. methods for testing plastics (7). The next meeting of I.S.O./T.C. 61 is scheduled to be held in Great Britain in September 1954.

In the United States, highlight of the year in standards work was the adoption of the Commercial Standard CS 192-53 for General Purpose Vinyl Plastic Film, culminating several years work by technical committees of The Society of the Plastics Industry (8). A revision of Simplified Practice Recommendation R242-53 for Vinyl- and Pyroxylin-Coated Cotton Fabrics added 16 styles of vinyl-coated fabrics to the original list of 20 vinyl-coated and 25 pyroxylin-coated fabrics in a standard prepared by the Plastics Coating and Film Association (9).

Table II—World Export Trade in Plastics

Period	*U. S. A.*	*Great Britain*	*Western Germany*
	10^3 tons	*10^3 tons*	*10^3 tons*
1952	57.1	42.3	20.5
1953	61.4[a]	52.1[b]	26.5[c]

[a] Based on first three months. [b] Based on first six months. [c] Based on first five months.

The realization that the Commercial Standards for melamine tableware and polystyrene wall tile, and now for vinyl film, can and are proving to be a potent factor in the acceptance of plastics products by the public is responsible for considerable increased activity in this direction by The Society of the Plastics Industry and other groups. Among the products for which standards are now under development are thermoplastic pipe, reinforced plastics pipe, thermoplastic chemical-resistant structural equipment items, hospital sheeting, saran monofilaments, and reinforced plastics flat and corrugated sheeting for the building industry.

Materials

Acrylics—The multiaxial hot-stretching of polymethyl methacrylate 100 to 150% converts the amorphous brittle cast plastic into an oriented tough laminar material which is craze- and shatter-resistant (10). Fabricators have developed methods of utilizing this characteristic of hot-stretched acrylic plastic in aircraft canopies and experimental installations of hot-stretched acrylic glazing are undergoing observation tests on aircraft. Cross-linked modifications of polymethyl methacrylate with somewhat greater heat and craze resistance have become available on a pilot-plant scale (11, 12). The problem of stress-crazing of acrylic plastics was investigated by a number of authors (13-15). Useful data were published on the calculation of heat loss through acrylic glazing (16), dimensional changes due to thermal and humidity fluctuations (17), creep behavior (18), and strength-orientation relations (19).

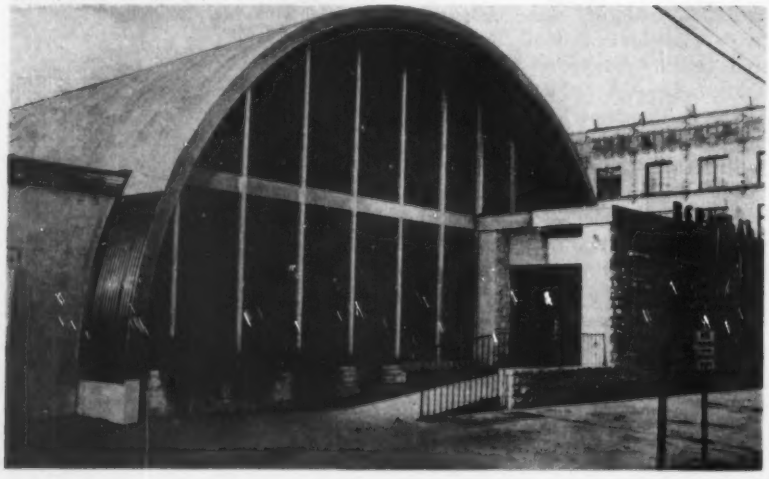
An emulsion of polyvinyl butyral resin in water provides a sprayable and strippable coating for transparent acrylics to serve for masking and protective purposes (20).

Acrylate soil conditioners are now moving at the rate of about four million lb. annually with a fifty million-lb. market predicted in 5 to 10 years (21). Research on new acrylic polymers (22), polymerization of polymethyl methacrylate (23, 24), and degradation of polyacrylonitrile (25) was described.

Cellulosics—Developments in diverse derivatives of cellulose were reported, including carboxymethyl cellulose (26), hydroxyethyl cellulose (27), butylhydroxyethyl cellulose (28), cellulose acetate (29-31), cellulose acetate butyrate (32), and cellulose nitrate (33). A hot-melt ethyl cellulose compound has proved to be advantageous in the production of drop hammer dies for the aircraft and automotive industries, yielding savings in tool weight and man-hours (34). The use of butyrate pipe for gas, oil, and water lines continues to expand, based on satisfactory service performance since 1945 and on economies in installation costs compared with copper and steel pipe (35). Production of cellophane in the United States is now about 300,000,-

Light-transmitting structural panels of fibrous glass reinforced plastics find increasing architectural applications in building fronts, facades, and the like

Courtesy Corrulux Div., Libbey-Owens-Ford Co.



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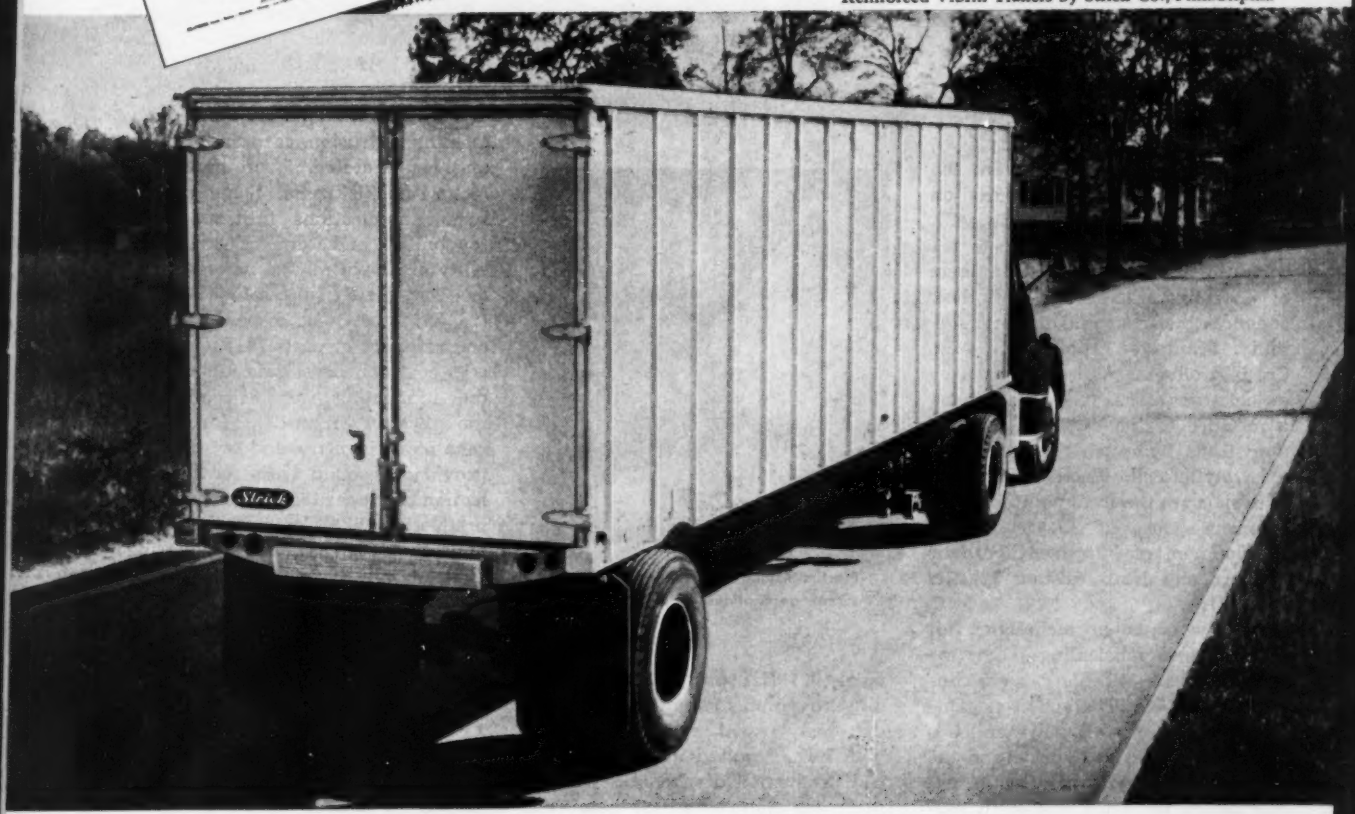
Reinforced Vibrin Trailers by Strick Co., Philadelphia



Less than two years ago, Naugatuck first announced a dent-proof, rust-proof **car body** of Vibrin polyester and glass fibers. Now this amazing reinforced plastic is being used to construct heavy-duty **truck trailers!**

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Division of United States Rubber Company

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000 lb. annually (36). A 100-year old molding material based on ground wood bonded with natural substances was commemorated (37).

Ethylene Polymers—Polyethylene is the fastest growing material in the plastics field today; total capacity is expected to reach about 500 million lb. annually by the end of 1955 (38). The major fields of application for this polymer include bottles and containers, housewares (39), toys, electrical insulation, industrial machine parts, tapes (40), and tubing (41). Exposure of polyethylene to radiation in an atomic pile produced crosslinking and consequent change to properties characteristic of a thermoset material (42). Melt flow (43), specific heat (44), flammability (45), and oxidative aging (46) were the subjects of noteworthy reports on the properties of polyethylene (47).

The fluorocarbons continue to receive the attention of large numbers of investigators because of their chemical inertness and thermal stability. Minnesota Mining and Mfg. Co. is producing fluorochemicals by an electrochemical process involving a mixture of the organic base and anhydrous hydrogen fluoride in an electrolytic cell. These monomeric materials are the focal point for government-sponsored research on the development of improved synthetic rubbers and heat-resistant plastics (48, 49).

Improvements in techniques for molding and fabricating polytetrafluoroethylene (Teflon) were described (50-54). The action of gamma radiation on this polymer leads to the evolution of fluorine and the formation of unsaturated bonds, accompanied by deterioration in mechanical strength (55). A study of the behavior of polytetrafluorethylene under pressure revealed that phase changes occur at ordinary temperatures which are of importance in gasket applications (56). Polymerization of tetrafluoroethylene (57) and perfluoro-olefins containing 3 to 9 carbons (58) were investigated; the latter compounds would not polymerize alone, but could be copolymerized with ethylene, vinyl chloride, vinyl acetate, and vinyl alkyl ethers.

Rapid quenching of extruded polychlorotrifluoroethylene (fluorothene) film to avoid the formation of harmful crystallinity was shown to be essential to obtain good clarity and optimum flexibility, toughness, and impact resistance (59). Molding techniques (60) and methods of evaluating the flow characteristics (61) of this polymer were described. The polymerization of chlorotrifluoroethylene (62, 63) and molecular structure (64) and stability (65) of the polymer were investigated.

The processing and properties of the recently developed elastomer, chlorosulfonated polyethylene (Hypalon S), were described (66-68).

Phenolics—The 1952 Hyatt Award was presented to Dr. Howard L. Bender for his research on the relationships between molecular structure and properties of phenolic polymers (69). His observation that 2,2′-dihydroxydiphenylmethane has an extremely rapid crosslinking rate with hexa resulted in the commercial production of phenolic molding materials combining fast cure rate with hot rigidity (70). A phenolic-type heat-resistant low-pressure laminating resin for use with glass fiber reinforcement (71), and a high-impact phenolic molding compound containing 1 in. long glass fiber rovings as the reinforcing filler (72) were announced. Interesting new information on the reactions of casting-type phenolic resins was reported; modification of these resins with 1,2-epoxides leads to a polyhydric alcohol which can be esterified with organic acids to produce plasticizers (73, 74). Residual stresses in phenolic plastics, which may cause distortion when a molded part is finished by machining, were investigated (75).

Courtesy Waltco Products.

Plastics fishing reel is one of many recent applications of molded nylon

Polyesters—Reviews of the development of the alkyl resins and their basic chemistry were published (76-79). Molding compounds based on polyester resins and inorganic fillers (glass or asbestos fibers) are finding new applications in electrical equipment (80-83). Polyethylene terephthalate, the polyester resin which is used to produce Dacron fiber and Mylar film, was the subject of two reports detailing the unique properties of this polymer (84, 85).

Styrene Polymers and Copolymers—The versatile styrene copolymers and alloys continue to take over jobs formerly performed by metals; their adaptability to shaping by a variety of methods, including injection molding, extrusion, vacuum forming, and bag molding, is an important factor in this trend. Some of the recent applications utilizing their toughness and dimensional stability are lawn mower wheels (86), machine guards (87), safety helmets (88, 89), fruit juice dispensers (90), and refrigerator parts (91).

A comprehensive investigation of the fabricating variables affecting the physical properties of polystyrene monofilaments and bristles has provided a sound basis for the selection of proper techniques for their production (92). Compounding (93), annealing (94, 95), and lacquering (96) of polystyrene products were discussed. New information was published on the physical (97-99) and electrical (100) properties of polystyrene and its polymerization (101, 102) and chemical modification (103).

Vinyl Polymers and Copolymers—The important position of vinyl acetate in the plastics field was emphasized in a review of the properties and uses of polymers produced from it (104). The yearly production estimates in millions of pounds are: vinyl acetate 75 to 95; polyvinyl acetate 45; polyvinyl alcohol 12 to 14; polyvinyl butyral 15 to 20. The present consumption estimates for polyvinyl acetate are: adhesives 55%; textile and paper finishes 25%; surface coatings 15%; miscellaneous uses 5%. It is forecast that production of polyvinyl acetate in 1957 will be 100 million lb., with most of the increase going into surface coatings.

The compounding and processing of rigid polyvinyl chloride (105-107) and of plastisols (108-110) and plastigels (111, 112) received consider-

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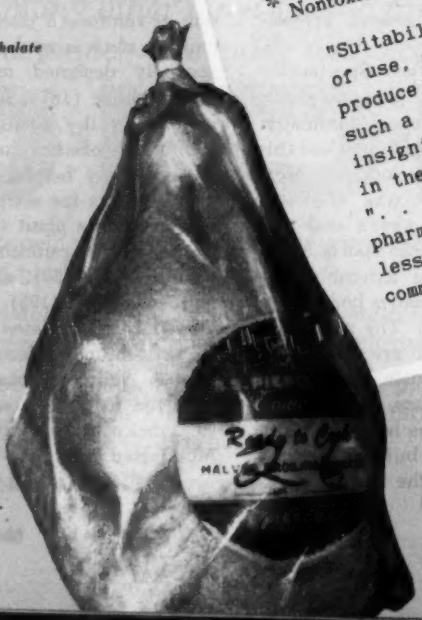
- **Cabflex Di-OP** *di-iso-octyl phthalate*
- **Cabflex DOCP** *di-iso-octyl capryl phthalate*
- **Cabflex Di-OA** *di-iso-octyl adipate*
- **Cabflex DDP** *di-decyl phthalate*
- **Cabflex DDA** *di-decyl adipate*
- **Cabflex Di-BA** *di-iso-butyl adipate*
- **Cabflex Di-OZ** *di-iso-octyl azelate*
- **Cabol 100** *hydrocarbon oil plasticizer*



Cabot produces the nontoxic plasticizer Cabflex Di-BA and does not make the finished film.

Plastics Chemicals Division

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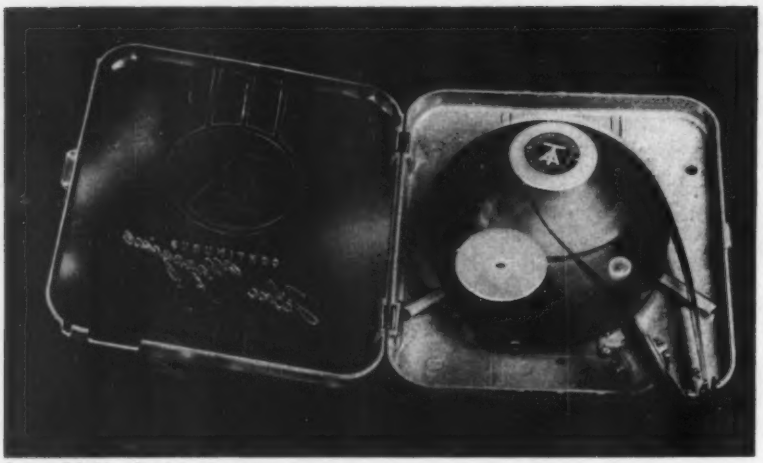

Courtesy Television Associates, Inc.

During 1953, more and more optical and photographic equipment was designed to utilize properties of the various plastics materials to their fullest degree

able attention. An important innovation in the plastics film field is a "porolated" vinyl film containing as many as 64 mechanically produced tiny holes per sq. in.; these perforations permit transmission of air but not water (113). Improved methods were described for injection molding (114, 115) and extrusion (116) of vinyl materials and for printing and finishing vinyl sheeting (117-119). Recent developments in vinyl-metal laminates (120, 121), vinyl-vinylidene chloride rigid sheet (122), saran screening (123), and rainwear (124) were reported.

Comprehensive reviews covered plasticizers (125-128), stabilizers (129-131), and colorants (132) for vinyl compounds. Procedures for controlling lead dust in the manufacture of vinyl plastics were developed (133).

Equipment for testing flow (134) and hardness (135) of vinyl plastics (136) was described. The effects of heat, light, and weathering on polyvinyl chloride were reported (137, 138). New data were published on polyvinylpyrrolidone (139, 140), hydroxyethylpolyvinyl alcohol (141), and vinyl acetate copolymers (142).

Other Polymers—A polyurethane elastomer possessing high tensile strength and exceptional resistance to abrasion and oxidation has been announced under the trade name Chemigum SL. It is comparable to the German product Vulkollan and is expected to find a market in shoe soles and heels, floor coverings, protective coatings, and industrial belting and rubber-type products (143). Hydrogenation of the common synthetic rubbers produces thermoplastic resins resembling polyethylene, but generally more flexible at low temperatures (144). Recent developments in the use of epoxy resins in laminates, adhesives, potting compounds, and foamed products were reported (145, 146). Other authors dealt with silicones (147), aromatic polyphosphates (148), alkyds (149), coumarone-indenes (150), nylon molding materials (151, 152), elastomers (153) chlorinated paraffins (154), waxes (155), ion exchange resins (156-161), furfuryl alcohol (162), phenol-furfural (163), and phenol, urea, and melamine resins (164). Induction heating is reported to have advantages over other forms of heating in resin manufacture (165). Polymerization phenomena were described by several investigators (166-172).

Reinforced Plastics—Spectacular encroachment of glass-polyester plastics into end uses dominated hitherto by metals again marked this branch of the plastics industry. Most significant perhaps was the announcement at the year's end that the Chevrolet Corvette sports car is now rolling off the assembly line with a reinforced plastics body made up of 41 parts (173). The major assembly components are the front and rear fender panels, doors, seat, hood and trunk covers, and the one-piece underbody; the latter is 9½ ft. long by 6 ft. wide, but weighs only 75 pounds. Cost of the tooling is reported to be $500,000 compared with an estimated $4,500,000 for its steel counterpart; there is also a comparable reduction in the time required to get the car into production. The present rate of production is three cars daily with a projected output of 30 automobiles per day in 1954.

Another field which the reinforced plastics have invaded is the construction of tanks for chemicals, oils, and fuel transportation (174). An outstanding example is the 3½-ton one-piece transport tank 22 ft. long, 6 ft. wide, and 4½ ft. high, built to haul chemicals (175). Other recent noteworthy applications of the reinforced plastics include a 2-man miniature submarine weighing only 155 lb. (176), an air tank for jet aircraft 35% lighter than its steel counterpart (177), the weather-resistant 6 ft. high 200-lb. "Fisk Boy" display (178), specially designed lightweight luggage (179), translucent hurricane window covers (180), and dies for forming cold-rolled and stainless steel parts by the thousands (181). These and other developing uses for reinforced plastics are responsible for the widespread interest displayed at the 1953 Reinforced Plastics Conference which was attended by 1416 representatives of 437 companies (182).

Valuable information was published on the properties of glass fabrics (183), finishes to obtain high wet strength (184), and inorganic fillers to improve surface finish and reduce materials cost (185). Developments in special phenolic (71), epoxy (145) and silicone (186) resins for low pressure molding and laminating were reported. Continuous production of reinforced plastics tube, rod, and bar stock is now performed by a specially designed machine called a Glastruder (187). An experienced pioneer in the custom molding of reinforced plastics has contributed an extremely helpful survey of the requirements for setting up and operating such a plant (188). New information was published on the mechanical (189-193), electrical (194), and chemical (195) properties of glass-fabric laminates (196-197).

Postforming of decorative and industrial cellulosic-base laminates is reported to be an increasingly useful fabricating technique (198-199). Metal-clad cellulosic-base laminates are also widely used in the produc-

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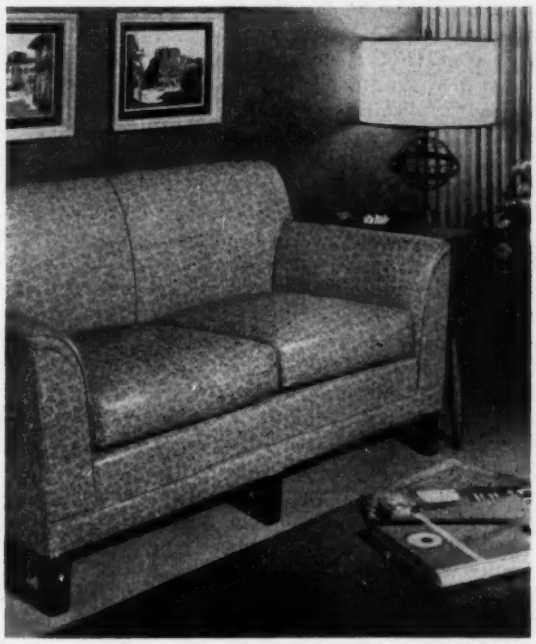

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tion of printed circuit panels for electronic equipment (200).

Expanded Plastics—The announcement of three new foaming-type plastics is indicative of current interest and potential applications of such products in industrial and consumer applications (201). Two of the newly available materials, Armofoam and Lockfoam, are of the polyurethane type, based on the reaction of polyisocyanates with polyesters; they are suitable for foamed-in-place applications (202, 203). The third, Colfoam, is a urea-formaldehyde resin product, available in block, thin slab, and shredded forms. The properties and applications of other plastics foams, such as those based on polyethylene, polystyrene, polyvinyl chloride, and phenolic resins, were reviewed by other authors (204-207). One outstanding use of phenolic foam is the replacement of balsa wood for buoyancy purposes in the hulls of small aircraft carriers. One carrier installation involved the use of 40,000 lb. of phenolic resin in 8100 cu. ft. of void space; cost was reduced 75% and installation time about 60% (208). The effects of vibration on phenolic foamed plastics were investigated (209).

Plasticizers—The vinyl plastics are still the chief consumer of the approximately 300 million lb. of plasticizers produced annually in this country (125-128, 210). Investigations of polyester (211), aconitic and tricarballylic acid ester (212), and ether ester plasticizers (213), were also reported. Other noteworthy reports related to plasticizer-polymer interaction (214) and toxicity studies (215).

Processing

Molding—Outstanding among major advances made during the year in molding machinery (216, 217) were fully automatic injection machines (218, 219), a high speed injection machine capable of 1200 shots per hr. (220, 221), an improved extrusion machine which permits faster operation and cleaning (222), and an economical method for producing glass-fiber-reinforced plastics bar, rod, and tube stock in continuous lengths (187).

The basic concepts of extrusion were explored by many investigators and the principles developed were put to practical use in the design of extruders to handle nylon melts and to predict the performance of large extruders from tests of models (223-234). Likewise, the fundamentals of injection molding were examined (235) and used as the basis for the design of an improved pressure gage (236) and heating chambers (237) and for the solution of problems arising in the production of large-area thin molded pieces (238, 239). Special techniques involved in the injection molding of rigid polyvinyl chloride (240), covering rivet heads by the injection process (241), and the blow-molding of polyethylene bottles (242) were described. Valuable pointers were given on the selection and layout of injection molding plant equipment to obtain increased efficiency (243) and on the avoidance of fire hazards (244, 245).

The plastics industry and its customers are becoming more quality conscious; a practical means of maintaining quality of molded parts, reducing rejects, spotting design defects, and increasing productivity through statistical quality control records was outlined by a production expert (246).

Progress in the design of heating equipment (247, 248) and temperature (249, 250) and pressure (251) controls was reported. Coloring of styrene (252) and vinyl (132) compounds, granulating of thermoplastics (253), and detecting of cracks in molded parts by the use of fluorescent ink (254) were discussed. Tests showed that tumbling of drums is far superior to rolling as a means of reblending the fines and granules of molding powders after shipment (255). Special problems in compression molding were solved (256-258).

A new technique for making preforms for molding reinforced plastics parts was described; designated as the "Aqua-glas" method, it consists of wet processing a slurry of glass and cellulosic fibers.

The process is reported to offer greater speed in production and removal of preforms from the screen, adaptability to a wide range of sizes and shapes, and economy commensurate with required physical strength (259). Various difficult problems in the molding of reinforced plastics were investigated and solved (173-179, 260).

Casting—Complete details on the process of embedment of specimens in cast acrylic blocks were set forth, including directions for the preparation of the materials to be preserved and for the machining of the finished casting (261). Another outstanding contribution in this sector of the industry described the production of inexpensive molds for slush molding,

Transparent acrylics can be covered for masking and protective purposes with a sprayable and strippable coating of a polyvinyl butyral resin-water emulsion

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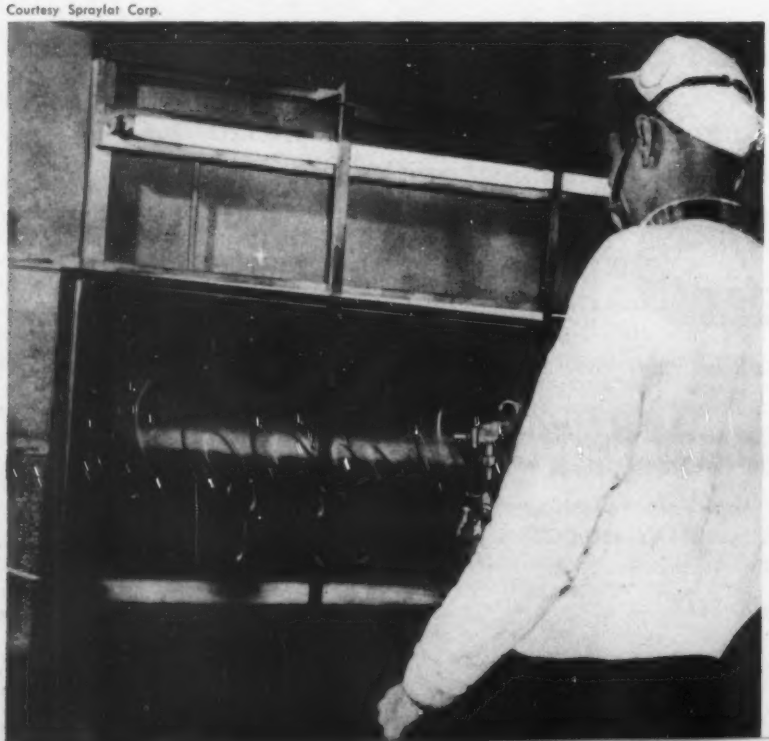

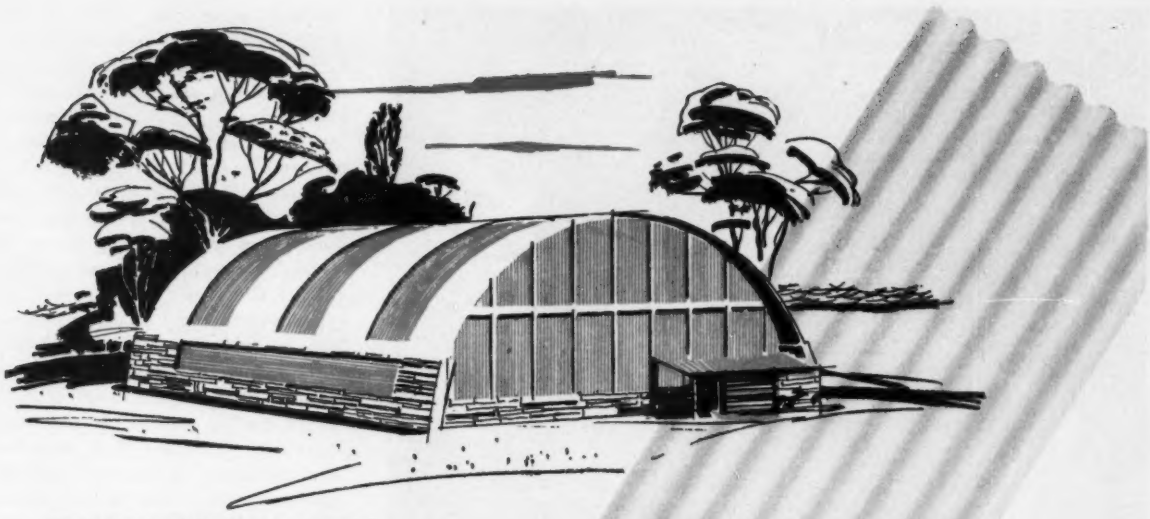

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Courtesy Hawley Products Co.

New technique for making preforms for reinforced plastics parts (lockers, in this example) consists of wet processing a slurry of glass and cellulosic fibers

the operations by which vinyl plastisols are slush molded, and the decoration of the molded pieces (262). A versatile vinyl plastigel for modeling uses was announced (263).

Fabricating and Finishing—Vacuum forming of thermoplastic materials, which have been given multi-color decoration in flat sheet form, is taking a competitive position with other high-speed plastics molding operations (264-267). Advances in equipment and processes for vacuum metallizing plastics sheet materials (268-270), automatic embossing of molded parts with colored inscriptions (271), decorating of plastics products (272, 274), and flameless welding (274) were reported. Useful suggestions regarding the solution of problems arising in grinding (275) and drilling (276, 277) operations were presented.

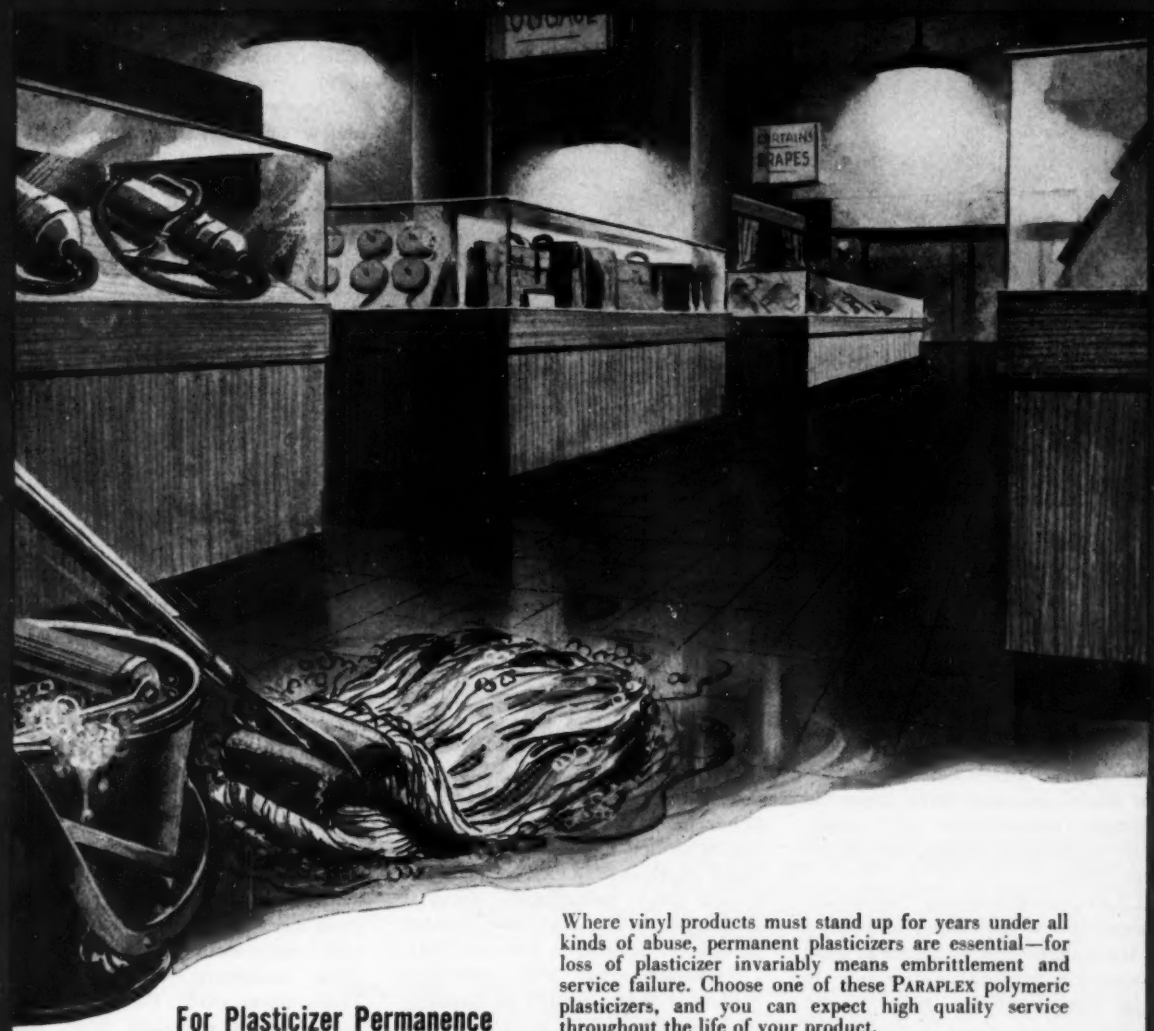
Applications

A significant trend by designers to conceive an end product in terms of integrated plastics parts was noted during the past year (278). Among the many applications in which this approach was emphasized may be mentioned the Chevrolet Corvette car body (173), a miniature submarine (176), business machines (279-282), air conditioners (283-285), fruit juice dispensers (90), refrigerators (286, 287), record players (288), radios (289), televisions (290), photocopier (291), and luggage (179). The increasing availability of tough dimensionally stable materials, such as glass-fiber reinforced plastics and styrene alloys, and the know-how that is accumulating on economical and dependable methods of fabricating these plastics are important factors in this departure from traditional designs based on metals and wood (292).

Aircraft—The increasing importance of plastics as materials of construction in commercial and military aircraft was highlighted in a series of articles based on a Pacific Coast S.P.I. conference (293). Aircraft experts reviewed developments in transparent plastics (294), furnishings (295), tooling (34), primary structures (296-298), rocket and guided missile parts (299, 300), and armor plate (301). Many other authors dealt with these and related developments in aircraft applications of plastics (302-312). Especially noteworthy was a description of the conversion of DC-6 airplanes to tourist service; sandwich construction material made of glass-fiber reinforced skins and cellulose acetate foam was used to install baggage racks and a water tank compartment, with a resultant increase in load-carrying capacity, a major saving in weight, and a reduction in motor noise inside the cabin (313).

Automotive—The year 1953 saw the beginning of assembly line production of reinforced plastics car bodies by a major U.S. manufacturer (173). Chevrolet engineers have calculated that a 15,000 car production is at present the break-over point below which it is more economical to make the body of reinforced plastics instead of sheet steel. It can be expected that improved manufacturing techniques and advantages to the buyer and manufacturer in handling and refinishing costs will rapidly raise that figure during the next few years (314, 315). Equally impressive have been the developments in recent months in the use of reinforced plastics for construction of the bodies and doors of trailer-trucks (316, 317) and the tanks for liquid transport trucks (174, 175). Other important contributions of plastics to improved car performance have been noted in ignition assemblies (318), batteries (319-322), bumper guards (323), seat cushions (324), transmission speedometer driving gears (325) and air conditioning systems (326). The automotive industry as well as the aircraft industry is using production dies and assembly and inspection tools made of reinforced plastics to reduce costs and speed up mass production (181, 327).

Building — Light-transmitting structural panels of glass-fiber reinforced plastics and acrylics are finding rapidly expanding markets in architectural applications, such as building fronts, garage doors, terrace shades, office partitions, factory glazing, skylights, and structural signs (328-332). A dome, 93 ft. in diameter at its base and 46 ft. high, was constructed for an exhibition hall by installing reinforced plastics panels over an aluminum framework; it is estimated that it is 18 times lighter than it would be if constructed of conventional materials (333). Reinforced plastics bath tubs weighing only 17 lb. in contrast to 180 lb. for the conventional enameled-metal tub are in production for use in trailers (334). Other developments in the use of plastics



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High degree of dimensional stability and toughness make styrene copolymers well suited for the molding of sturdy and durable lawn mower wheels

in the building industry pertained to wall (335-337) and floor (338-339) coverings, plumbing (340), heating systems (341) and Portland cement mortars containing 20% polyvinyl acetate which cure without dampening and have improved strength, extensibility, and resistance to abrasion, impact, and corrosion (342).

Chemical—A review of recent advances in the utilization of plastics in the construction of chemical plant equipment includes references to pipe, tubing, fittings, tanks, ducts, stacks, valves, racks, meter housings, tapes, and linings (343). Plastics pipe and tape coverings continued to interest increasing numbers of engineers in the process industries (35, 344-350). Vinyl protective clothing has been developed for use in atomic energy laboratories to guard employees against harmful radioactive particles (351). Many other applications of plastics in the chemical industry were described and reviewed (352-360).

Electrical—Electronic computing machines have become a major new market for molded and extruded plastics; six major companies are using millions of plastics parts in the special and commercial types which they are manufacturing (361). New information was published regarding conductive plastics (362) and electrets (363). Progress in the development of dielectric materials (364) and electrical insulating systems was reported (365-371).

Medical—Vinyl plastisols have been found to be especially suitable for the production of anatomical models because they simulate the texture and feel as well as the appearance of human organs (372). Other medical applications of plastics described include acrylic respirator shells (373), acrylic corneal lenses (374), polyethylene surgical appliances (375), and nylon-coated leather for prosthetic devices (376).

Packaging—The 1953 literature contained many reports of expanding markets for plastics films (377-384). Typical of these developments was the automatic film-packaging of dried fruits. By the old method 14 workers put out 35 filled bags per min.; the new automatic machine requires only 4 workers and produces 44 bags per min. at a cost much less than the standard carton (385). The uses of plastics for display purposes (386), in filling machinery (387), and in the processing of food (388) were described.

Photographic and Optical—Manufacturers of cameras and projectors (389-391), flash reflectors (392, 393), developing tanks (394, 395), and photographic accessories (396, 397), were outstandingly plastics-conscious in the design of their equipment. A 16-lb. injection-molded acrylic globe serves as the light diffuser for a new type of fluorescent fixture for highway lighting (398). Rigid polyvinyl chloride has proved to be advantageous for the reflectors of indoor fluorescent fixtures, particularly in corrosive atmospheres (399).

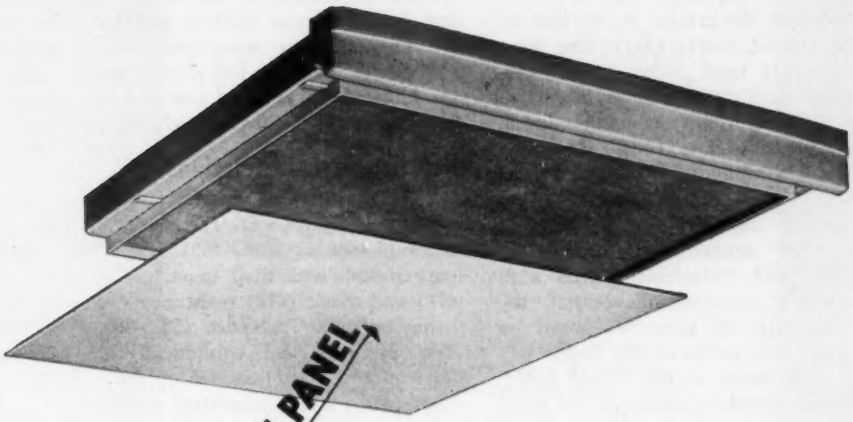
Miscellaneous—A comprehensive review on pressure-sensitive tapes pointed up the over-all job which plastics are doing in this expanding and highly competitive market, providing both the backing and the adhesive in many instances. The plastics films in use as tape backings include vinyls, polyethylene, cellulose acetate, Mylar polyester, and saran (400, 401).

Shell molding of foundry cores continued to grow as a major outlet for phenolic resins (402-407). An interesting corollary development is the use of a polyester fibrous-glass molding compound in place of metal to make the core drier, thereby permitting the use of dielectric heating in drying the cores. This has reduced the time of drying to ⅛ to 20 min. from the former ½ to 4 hr. and has decreased the cost of the core driers by ½ to ⅔ (408, 409).

In a survey of military applications of plastics, body armor made of nylon fabric or polyester glass-fabric laminates was given top billing. Additional items mentioned were a Coldbar suit made of expanded polyvinyl chloride and synthetic rubber, polyester fibrous-glass sleds for arctic transportation, cellulose acetate tray liners, melamine tableware, and resin-glass bread boxes (410). Plastics are being used as expellant bags, diaphragms, tubing, and gaskets in liquid propellant rockets (411).

Other noteworthy developments reported in 1953 were plastics file drawers (412, 413), vinyl covering for a trench silo (414), preservation of art works (415-417), butyrate pneumatic conveyor system (418), vinyl garden sprinkler (419), nylon fishing reel (420), and plastic-surfaced paper plate liners for food bars (421). Among the well-established fields of use for plastics in which advances were recorded were grinding wheels (422), laminated bearings (423), toys (424, 425), musical instruments (426), housewares (427), printing (428), tableware (429), boat construction (430-432), railway car interiors (433), and textile products (434-438) and machinery (439, 440).

Adhesives—The consumption of synthetic resins in adhesives is ex-



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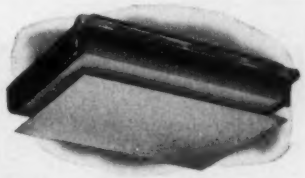

NOSCO PLASTICS, *division of National Organ Supply Co., Erie, Pa., is the molder who worked out this Polyflex application.*

PLAX

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pected to reach 245 million lb. in 1953 and 280 million lb. in 1955 in the United States (441). The most commonly used resins in wood-to-wood bonding are those based on phenol, resorcinol, melamine, urea, and vinyl acetate (442). Metal-to-metal bonding is widely practiced now in the aircraft industry and can be expected to be adopted by the automotive, shipbuilding, and other industries where high strength requirements exist; the availability of adhesives based on epoxy and polyurethane resins will give impetus to this trend (443). Developments in adhesives for reinforced plastics (444) and heat-sealing films (445) were reviewed (446). New information was published on the properties and testing of adhesives (447-451).

Coatings—The annual consumption of synthetic resins in protective coatings in the United States is now approximately 800 million pounds. One of the latest depelopments in this field is latex wall paint; these water emulsions are made with polymers and copolymers of butadiene, styrene, vinyl, and vinylidene compounds (452). New uses for strippable plastic coatings were discussed (453, 454). Two unusual jobs performed by plastic coatings are found in the vinyl-plastisol-coated tote basket for processing jet engine compressor blades through corrosive chemicals (455) and the polyester coating on concrete shielding blocks in an atomic research installation (456). Several reviews pertaining to the selection and formulation of plastics coatings for various uses were published (457-461). Methods of evaluating the adhesion of organic coatings to metallic surfaces were studied (462).

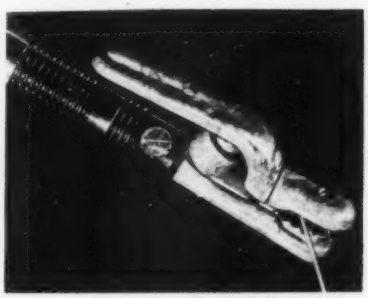
Properties, Specifications

The mechanical behavior and testing of plastics were reviewed by several authors (463-469). Other papers dealt with their impact (470, 471) and shock (472) resistance and behavior under pressure (56, 473). Test methods and equipment for determining hardness (474), stiffness (475), stress relaxation (476), and compression set (477) were described. In the field of thermal behavior, authors dealt with heat distortion measurements (478), rheological phenomena (479), and flammability (480). Optical properties considered included gloss evaluation (481, 482), refractive behavior (483), ultra-violet absorption spectra (484), and X-ray diffraction (485). Electrical tests for molded plastics (486), electro-static properties (487), and relationships between chemical structure and dielectric properties (488) were reviewed. Important contributions were made to our knowledge of the resistance of plastics to heat (489, 490), light (491, 492), and weathering (493-495), and the permeability (496-498) and diffusion coefficients (499) of polymers. Tests to determine the toxic and dermatitic properties of synthetic resins and test results were reported (500, 501).

Among the many applications which plastics find in the automotive field are plastisol-coated cranking motor field coils and parts for the ignition system

Analytical procedures were published for cellulose phthalate and polyvinyl phthalate (502), polyvinyl chloride (503), melamine moldings (504), urea-formaldehyde resins (505), and coating materials (506, 507). New techniques for the identification of polymers by examination of their pyrolysis products by infra-red (508, 509) and mass spectrometric (510) methods were described.

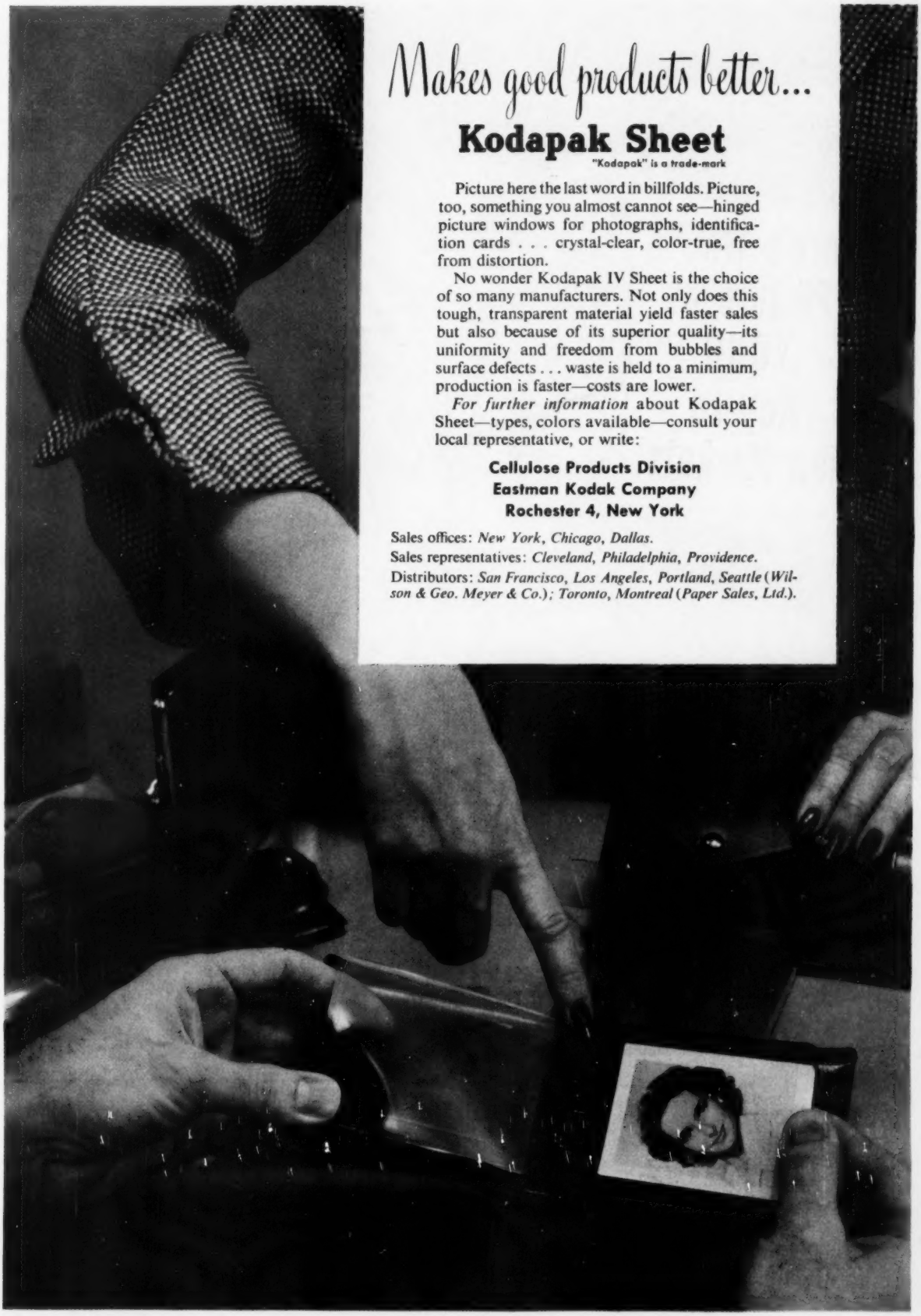
The relationships between molecular structure and properties of polymers is a branch of solid state



Courtesy Durez Plastics & Chemicals, Inc.
Welding electrode holder has molded glass-phenolic insulating parts

physics which is receiving increased attention and is providing basic facts needed for rational development of improved commercial products. These studies pertain to physical properties (511), viscoelastic behavior (512), glass transitions (513, 514), diffusion (515), volume effects (516-518), and thermodynamic interactions in solutions (519-521). Viscometry (522-526), osmometry (527-529), and light scattering (530, 531) were used in the determination of molecular weights of polymers (532, 533). The Commission on Macromolecules of the International Union of Pure and Applied Chemistry conducted a study of the reproducibility of molecular weight measurements made by various methods in laboratories in several different countries (534). Among the special techniques used to investigate structures of polymers were electron microscopy (535, 536), X-ray diffraction (537, 538), radioactive tracers, electrophoresis, and ultrasonics (539).

Committee D-20 on Plastics of the American Society for Testing Materials adopted three new methods of test, namely, resistance to abrasion



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of plastics materials (D1242-52T), specific viscosity of vinyl chloride polymers (D1243-52T), and shrinkage of molded and laminated thermosetting plastics at elevated temperatures (D1299-53T), and revised the test for resistance of plastics to chemical reagents (D543-52T). It adopted three new specifications covering polyethylene molding and extrusion materials (D1248-52T), primary octyl phthalate ester plasticizers (D1249-52T), and laminated thermosetting decorative sheets (D1300-53T), and revised specifications for phenolic molding compounds (D700-52T), nylon injection molding and extrusion compounds (D789-53T), and vinyl chloride polymer and copolymer rigid sheets (D708-53T). New definitions of terms relating to plastics (D883-53T) were also approved (540).

Committee D-14 on Adhesives (541) adopted a test for effect of mold contamination on permanence of adhesive preparations and adhesive bonds (D1286-53T), revised the method for strength properties of adhesives in shear by tension loading (metal-to-metal) (D1002-53 T), and approved new definitions of terms relating to adhesives (D907-53T).

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(Continued on page 189)

PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

Materials

CHLOROSULFONATED POLYETHYLENE. I. A NEW ELASTOMER. R. E. Brooks, D. E. Strain, and A. McAlevy. India Rubber World *127*, 791-93 (Mar. 1953). The composition and structure of a new elastomer made by treating polyethylene with chlorine and sulfur dioxide is discussed. This new material can be readily compounded and processed in conventional rubber machinery. It has excellent abrasion resistance and unusual durability on exposure to ozone, oxygen, heat, and the weather. Because it retains its physical properties so well under a variety of exposure conditions, it is expected to find use in the automotive, wire and cable, protective coatings, and mechanical goods, and other industries.

CHLOROSULFONATED POLYETHYLENE. II. METAL OXIDE CURING SYSTEMS. M. A. Smook, I. D. Roche, W. B. Clark, and O. G. Youngquist. India Rubber World *128*, 54-58 (Apr. 1953). The mechanism of the metal oxide curing reaction for chlorosulfonated polyethylene is discussed. The curing systems which have been studied most are based on a polybasic metal oxide or a polybasic metal salt of a weak acid, an organic acid, and an organic accelerator. The main cross-linking reaction in this system is believed to be the reaction between the metal oxide and sulfonic acid groups from the polymer chain. The rate of cure is accelerated very markedly by the addition of water to the formulation. The mechanisms by which curing agents, such as organic and inorganic bases, and organic accelerators, affect the rate of curing are discussed. Some of the effects of variation in curing components on various properties of the elastomer are presented.

CHLOROSULFONATED POLYETHYLENE. III. ORGANIC CURING AGENTS. W. F. Busse and M. A. Smook. India Rubber World *128*, 348-50 (June 1953). A practical gel test for screening potential curing agents for chlorosulfonated polyethylene is presented. In a very short time the order of reactivity and an indication of ultimate strength to be obtained from a curing system can be determined. Although this polymer is normally cured through the formation of salt bridges between sulfonyl chloride groups on adjacent chains, the material may also be cured by other reactions and through other groups. This paper discusses a few of these cures, using organic curing agents such as polyamines and polyhydroxyl compounds. Many of the organic curing agents give products comparable to those obtained with metal oxide cures, whereas others give novel properties or make possible novel methods of cure.

*Reg. U. S. Pat. Off.

Molding and Fabricating

PROPER FABRICATION OF UNPLASTICIZED P.V.C. EQUIPMENT. G. S. Laaff. Chem. Eng. *60*, 312-18 (June 1953). The design engineer must be aware of the proper fabrication methods and the corresponding design kinks to derive the benefits available from the correct use of polyvinyl chloride in making chemical equipment. The chemical nature of unplasticized polyvinyl chloride and tests for identification of the material are discussed. The problems and techniques of welding are well illustrated with examples of good and bad welds. Proper design of joints and corners is also illustrated.

THIS FABRICATING BUSINESS. Canadian Plastics *1953*, 45-48 (May-June 1953). The fabrication of rigid sheet materials into end products is reviewed. The sheet materials used are listed with their properties; various fabricating procedures are discussed; and the economics of the field are briefly outlined.

EXTRUSION OF STYRON. E. Kropscott. Canadian Plastics *1953*, 79-93 (May-June 1953). A detailed and complete description of the extrusion of Styron is given. The techniques and control factors in material and machine are described.

Applications

NEW NON-RIGID MATERIALS FOR THE FUNCTIONAL DESIGN OF ELECTRICAL INSULATING SYSTEMS. A. E. Javitz. Elec. Manuf. *52*, 123-38 (Sept. 1953). Progress in the field of insulation wrappings and the properties of these materials are described in detail. A discussion is given of the advantages and limitations of film, tape, sheet, and paper insulation. Plastics materials included are polyester, polytetrafluoroethylene, polytrifluoromonochloroethylene, nylon, cellulose triacetate, polyvinyl chloride, polystyrene, and flexible epoxy resins. Typical results for electrical evaluation tests are given and practical uses are suggested for the various materials.

POLYETHYLENE–HOUSEWARE'S LATEST WORKHORSE. Canadian Plastics *1953*, 43-45 (Mar.-Apr. 1953). A summary is given of the properties of polyethylene film and sheet. The growth of this plastic material in the household field is described.

Properties

STRESS-RUPTURE TESTS OF A GLASS-FABRIC-BASE PLASTIC LAMINATE. K. H. Boller. Forest Products Laboratory Report No. 1839 (June 1953). Stress-rupture tests of a glass-fabric-base plastic laminate made with a typical polyester-type resin show that the maximum tensile stress that can be sustained for a period of 300 hr. is, for an unnotched laminate, about 60% of the unnotched static tensile strength, and for a notched laminate, about 55% of the notched static tensile strength. Notching reduces the level of stress that can be sustained for this period to 46% of the static tensile strength of the unnotched laminate, a reduction of about 20 percent.

REFRACTOMETRIC DETERMINATION OF SECOND ORDER TRANSITION TEMPERATURES IN POLYMERS. VI. EFFECT OF MOLECULAR WEIGHT ON THE TRANSITION TEMPERATURE OF POLYVINYL ACETATE. R. H. Wiley and G. M. Brauer. J. Polymer Sci. *11*, 221-24 (Sept. 1953). The transition temperatures of unfractionated vinyl acetate polymers increase from 17 to 26° C. as the molecular weight in-

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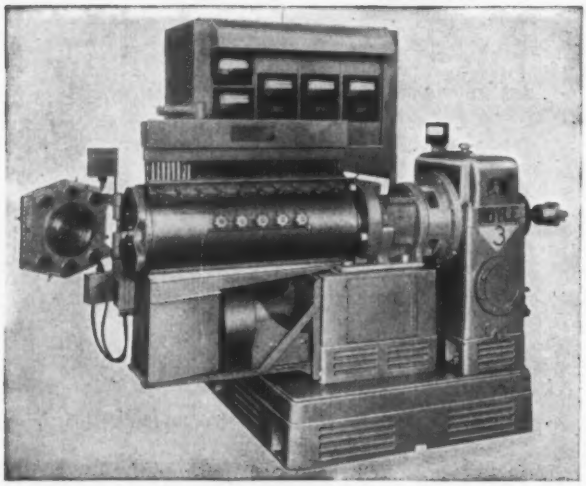

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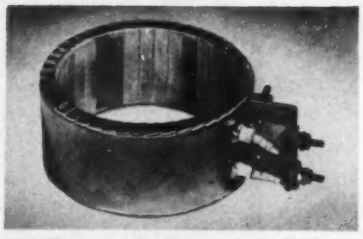

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creases from 14,000 to 104,000 and from 26 to 28° C. as the molecular weight increases from 104,000 to 1,120,000. The minimum molecular weight above which increase in molecular weight does not appreciably change the transition temperature is about 100,000. Transition temperature increases linearly with the reciprocal of the square root of the molecular weight.

TEXTURE OF SOME CRYSTALLINE SYNTHETIC POLYMERS BY ELECTRON MICROSCOPY. A. C. Cooper, A. Keller, and J. R. S. Waring. J. Polymer Sci. *11*, 215-20 (Sept. 1953). The surfaces of nylon and polyethylene were examined by electron microscopy. Evaporation *in vacuo*, casting from solvent or solvent mixtures, and ultrasonic disintegration produced surfaces which differed in appearance. In all cases the microfibrils are in a "sheaf-like" arrangement. There is evidence of periodicities, but these are considered to vary with the preparation, and may be a consequence of the helical arrangement and "rope-like" character of the bundles of microfibrils or of a tendency to form a weave-like texture.

Testing

A CONSTANT STRAIN STIFFNESS TESTER FOR THIN PLASTIC FILMS. F. D. Dexter. A.S.T.M. Bulletin No. 192, 40-47 (Sept. 1953). Apparatus for measuring the stiffness of plastic films, which utilizes a loop of the material and subjects it to a constant strain, is described. The precision of tests made with 0.004 in. thick vinyl plastic film is about ±2% at the 95% level. Variability in the thickness measurements and variation in thickness are greater than the test error. The test is capable of detecting small differences in plasticizer content and resin type.

Chemistry

COPOLYMERIZATION BEHAVIOR OF IONIZABLE MONOMERS. T. Alfrey, Jr., C. G. Overberger, and S. H. Pinner. J. Am. Chem. Soc. *75*, 4221-23 (Sept. 5, 1953). The copolymerization reactivity of methacrylic acid with both diethylaminoethyl methacrylate and acrylonitrile depends markedly on the pH of the system. This is interpreted in terms of the ionization of methacrylic acid at neutral and high pH values.

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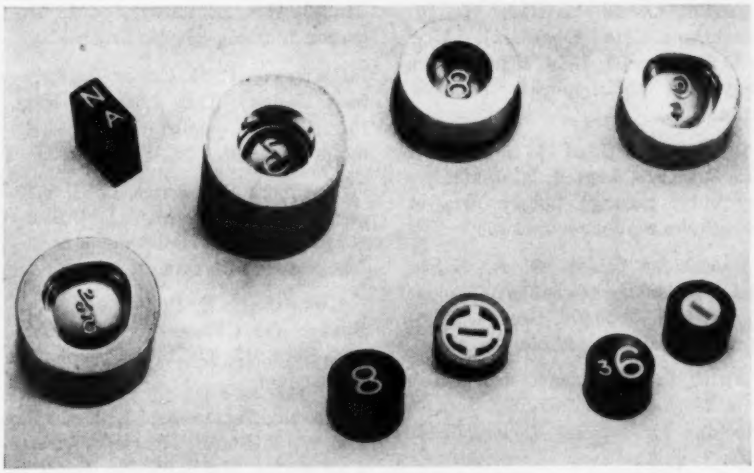

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

THERMOPLASTIC LATICES. H. M. Hutchinson (to Distillers). U.S. 2,650,912, Sept. 1. Heat treatment of coagulated thermoplastic polymer latices.

CATALYST. T. Boyd (to Monsanto). U.S. 2,650,913, Sept. 1. 2,2-bis(tertiary butyl peroxy) butane catalyst for ethylene polymerization.

LAMINATED GLASS. R. A. Gaiser and J. H. Boicey (to Libbey-Owens-Ford). U.S. 2,650,976, Sept. 1. Electrically conducting laminated glass.

FILM. L. Hornbostel (to Beloit Iron Works). U.S. 2,651,076, Sept. 8. Machine for forming thermoplastic film.

COATING. E. J. Justus (to Beloit Iron Works). U.S. 2,651,077, Sept. 8. Machine for applying a coating of thermoplastic film.

SHOES. A. A. Root (to United Shoe Machinery). U.S. 2,651,118, Sept. 8. Molding plastic soles and heels to shoe uppers.

ADHESIVE. E. C. Shokal, H. A. Newey and T. F. Bradley (to Shell Development). U.S. 2,651,589, Sept. 8. Bonding with glycidyl ether resins.

POLYMERS. G. H. Swart (to General Tire and Rubber). U.S. 2,651,624, Sept. 8. Curable unsaturated aldehyde polymers.

POLYMERS. W. L. J. de Nie (to Shell Development). U.S. 2,651,626, Sept. 8. Tripolymers of vinyl halide, vinylidene halide, and acrylic ester.

POLYMERIZATION. M. Prober (to General Electric). U.S. 2,651,627, Sept. 8. Polymerizing phenyl trifluoroethylene.

POLYSTYRENE. L. M. Welch (to Standard Oil). U.S. 2,651,628, Sept. 8. Process for alkylating polystyrene.

CELLULOSE ESTERS. B. B. White and E. Barbash (to Celanese). U.S. 2,651,629, Sept. 8. Production of cellulose acetate stearate.

BRUSHES. A. B. Snyder (to Owens Brush). U.S. 2,651,810, Sept. 15. Injection molding plastic brushes.

POLISHING. C. H. Coney (to Eastman Kodak). U.S. 2,651,811, Sept. 15. Solvent polishing injection molded plastics.

CELLULOSE DERIVATIVE. L. H. Yaeger (to Nash-Kelvinator). U.S. 2,652,339, Sept. 15. Solution of cellulose acetate butyrate.

LACQUER. R. E. Porzer and A. P. Baruch (to Celanese). U.S. 2,652,346, Sept. 15. Cellulose propionate gel lacquer.

PLASTIC TREATMENT. J. J. Carnes and W. T. Booth, Jr. (to American Cyanamid). U.S. 2,652,348, Sept. 15. Antistatic treatment of shaped vinyl articles.

MOLDED COMPOSITION. S. Z. Avedikian. U.S. 2,652,373, Sept. 15. Molded mass of wood fibers, cresol-formaldehyde resin, and sodium silicate.

RESINS. J. Rinse. U.S. 2,652,376, Sept. 15. Vegetable oils treated with epoxide resins.

RESINS. M. A. Kise (to Allied Chemical and Dye). U.S. 2,652,377, Sept. 15. Solutions of urea-formaldehyde resins.

INTERPOLYMERS. J. R. Caldwell (to Eastman Kodak). U.S. 2,652,378, Sept. 15. Mixtures of acrylonitrile polymers and vinyl acetate-fumaric amide interpolymers.

SOIL ADDITIVE. R. N. Hedrick and D. T. Mowry (to Monsanto). U.S. 2,652,379, Sept. 15. Linear olefinic carboxylic polymer.

COPOLYMER SALT. R. M. Hedrick and D. T. Mowry (to Monsanto). U.S. 2,652,380, Sept. 15. Soluble calcium salt of vinyl acetate and a monoester of maleic acid.

POLYMERS. C. H. Basdekis (to Monsanto). U.S. 2,652,381, Sept. 15. Calcium salt of a polymer of acrylic acid.

RESIN. J. F. Davis (to American Cyanamid). U.S. 2,652,382-3, Sept. 15. Polyester resin coating composition.

SILOXANES. M. J. Hunter and E. J. Smith (to Dow Corning). U.S. 2,652,385, Sept. 15. Siloxane resins.

BEADS. H. Wallman (to American Cyanamid). U.S. 2,652,386, Sept. 15. Continuous production of phenol-aldehyde beads.

CONDENSATES. W. Gruber, J. Heckmaier, and H. Zoebelein (to Wacker-Chemie). U.S. 2,652,387, Sept. 15. Condensates of polyvinyl alcohol and aldehydes.

RESIN. M. DeGroote (to Petrolite). U.S. 2,652,388, Sept. 15. Oxypropylated polyamide-polycarboxylic acid reaction products.

RESIN. M. S. Raasch and C. W. Tullock (to du Pont). U.S. 2,652,389, Sept. 15. Polyamide containing beta-carbonamido alpha-amino propionic acid units.

POLYMERIZATION. H. J. Hagemeyer, Jr. (to Eastman Kodak). U.S. 2,652,390, Sept. 15. Polymerization of alpha-acryloxy acrylonitriles.

COPOLYMERS. R. M. Schulken, Jr. and R. E. Boy, Jr. (to Eastman Kodak). U.S. 2,652,391, Sept. 15. Copolymers of alpha-methylstyrene and alpha-methacrylonitrile.

POLYMERIZATION. W. P. Hohenstein, R. N. Hayward, and J. Elly (to W. P. Hohenstein). U.S. 2,652,392, Sept. 15. Suspension polymerization of unsaturated organic compounds.

POLYMERIZATION. J. B. Dickey and H. W. Coover, Jr. (to Eastman Kodak). U.S. 2,652,393, Sept. 15. Polymerization with alkyl phosphite catalysts.

MILLING. R. Sullivan, A. Glendinning, and L. M. Read (to British Resin Products). U.S. 2,652,590, Sept. 22. Apparatus for continuous milling of plastics.

MOLDING. S. P. Kish (to Kish Plastic Products). U.S. 2,652,595, Sept. 22. Method of making models.

MOLDING. J. R. Sucher (to Emsig Manufacturing). U.S. 2,652,597, Sept. 22. Compression molding plastic materials.

CELLULOSE ETHER. N. B. Oakley (to Hercules). U.S. 2,653,108, Sept. 22. Carboxyethyl-hydroxyethyl cellu-

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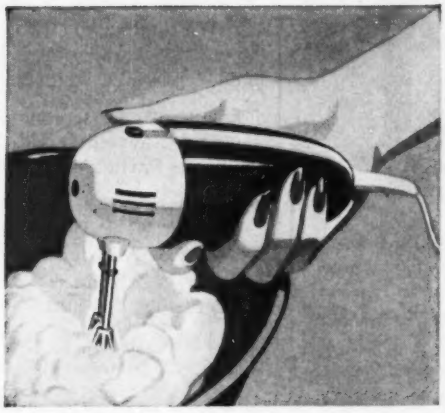

DESCRIPTIVE DATA

CELANESE* PLASTICIZER	GRADE	APPEARANCE	COLOR APHA Max.	SPECIFIC GRAVITY @ 20/20°C.	ACIDITY	ESTER VALUE % Min.	PERMANGANATE TIME, Min. (in Minutes)	REFRACTIVE INDEX @ n $\frac{25°C.}{D}$
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (2)	99	30	1.553
CELLUFLEX* 179C tricresyl phosphate petroleum base	Technical	Clear transparent liquid	150	1.165 ± .005	0.01 (2)	99	30	1.553
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20 (4)	1.202 ± .005 (1)	0.003 (3)	99	30	1.550 (1)
CELLUFLEX* 112 mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (2)	99	30	1.560
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.490
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.986 ± .002	0.01 (2)	98	—	1.485

(1) @ 60° C. (2) % as phthalic, max. (3) % as phosphoric, max. (4) molten

When specifications call for flame resistance, dimensional stability and dielectric strength the appliance manufacturer's key plasticizer is Celluflex TPP. TPP—triphenyl phosphate is fire-retarding...resists warping...produces clear formulations that are tough, never tacky.

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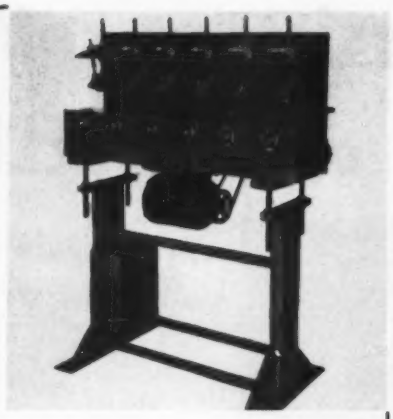
Extruded Pipe Pull-Off Helps Maintain Accurate Caliper



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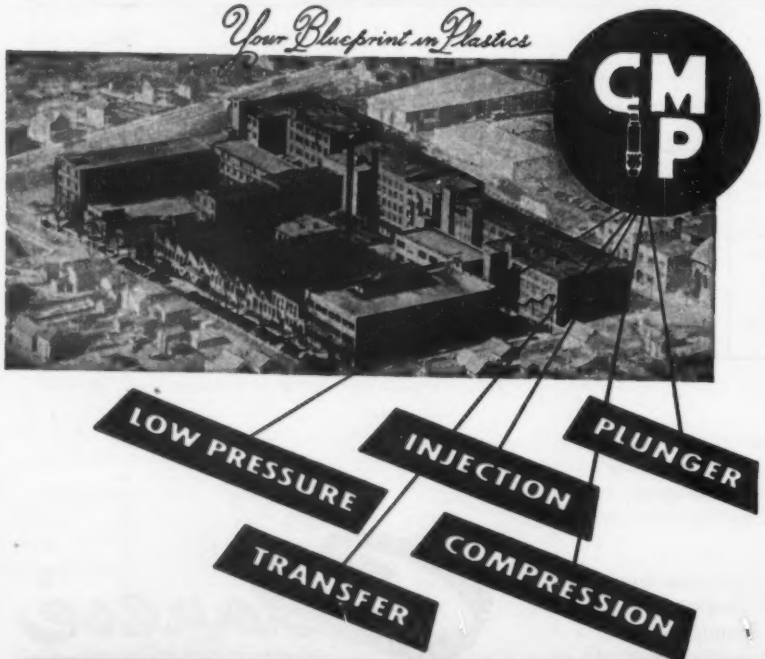

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lose plasticized with dipropylene glycol.

COATING. T. F. Banigan (to du Pont). U.S. 2,653,113, Sept. 22. Coating polyethylene articles with polyvinyl acetate and alkoxy phosphoric acid compounds.

CELLULAR BODIES. R. F. Sterling (to Westinghouse). U.S. 2,653,139, Sept. 22. Production of in-place expanded phenolic resins.

RESINS. S. O. Greenlee (to Devoe and Raynolds). U.S. 2,653,141, Sept. 22. Partial esters of polyhydroxyl polyethers.

RESINS. W. P. Cody and E. L. Clark (to Alkydol Laboratories). U.S. 2,653,142, Sept. 22. Ester resins for varnishes and inks.

CONDENSATES. P. L. de Benneville and V. C. Meunier (to Rohm and Haas). U.S. 2,653,143, Sept. 22. Condensates of formaldehyde and bis-aminotriazines.

COPOLYMERS. W. P. Hohenstein (to Whitney Blake). U.S. 2,653,145, Sept. 22. Rubber-like vinylidene copolymers.

COPOLYMERS. H. W. Gray and C. W. Theobald (to du Pont). U.S. 2,653,146, Sept. 22. Treating beta-methylene-beta-propiolactone copolymers with copolymerizable monomers.

EYES. A. L. Anderson and J. D. Holmen (to Precision Cosmet). U.S. 2,653,328, Sept. 29. Fabrication of plastic eyes.

PELLETIZER. R. P. Piperoux (to Celanese). U.S. 2,653,350, Sept. 29. Apparatus for forming plastic pellets.

EXTRUDER. G. E. Gliss (to Western Electric). U.S. 2,653,352, Sept. 29. Extrusion machine.

TEST APPARATUS. A. L. Simison (to Owens-Corning Fiberglas). U.S. 2,653,473, Sept. 29. Apparatus for determining binder properties of resins.

Post-Forming Patent

We have been informed that the process of post-forming as described in the article "Beauty Bent for Strength, Convenience, Economy," MODERN PLASTICS, November 1953, p. 113, is covered by U.S. Patent No. 2,433,643, owned by North American Aviation, Inc., Los Angeles, Calif.

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NEW MACHINERY AND EQUIPMENT

Injection Machine—Suitable for high-speed molding of thermoplastics at low mold cost, a 2-oz. automatic injection machine, Model 73, engineered by Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio, is of horizontal construction with four tie rods equipped with micrometer adjusting nuts for even distribution of pressure on four points of toggle clamp. The clamp is designed with a two-pressure hydraulic system using a Vickers Relief valve, so if a part is not ejected, the machine shuts down without damaging the mold. Maximum pressure on material at 1250 p.s.i. (on the oil) is 12,100 p.s.i.

The operating mechanism also includes a 45-gal. oil tank, a 5-hp. motor, Vickers hydrauilc pump, and heavy-duty oil heat exchanger.

The unit makes dry runs at 1200 cycles per hr. and is said to be capable of plasticizing 25 lb. of material per hr., fed from a 14-lb. metered hopper. Molding area is over 20 sq. in., and standard 8- by 9-in. DME mold blanks are employed.

Hydraulic action at end of forward and reverse stroke is cushioned for smooth ejection. Injection piston and top half of material receiving funnel are water cooled to reduce sticking of plastics. Torpedo-less material cylinder (Radee) is of stainless or chrome nickel steel.

A sliding type metal safety gate engages a limit switch before the machine can be operated. When the gate is open, the machine is inoperative. Controls on the machine itself include a manual and automatic selector switch, motor start and stop buttons, clamp close and open buttons, and injection buttons.

All electrical controls are contained in wall-mounted instrument cabinet and include the following:

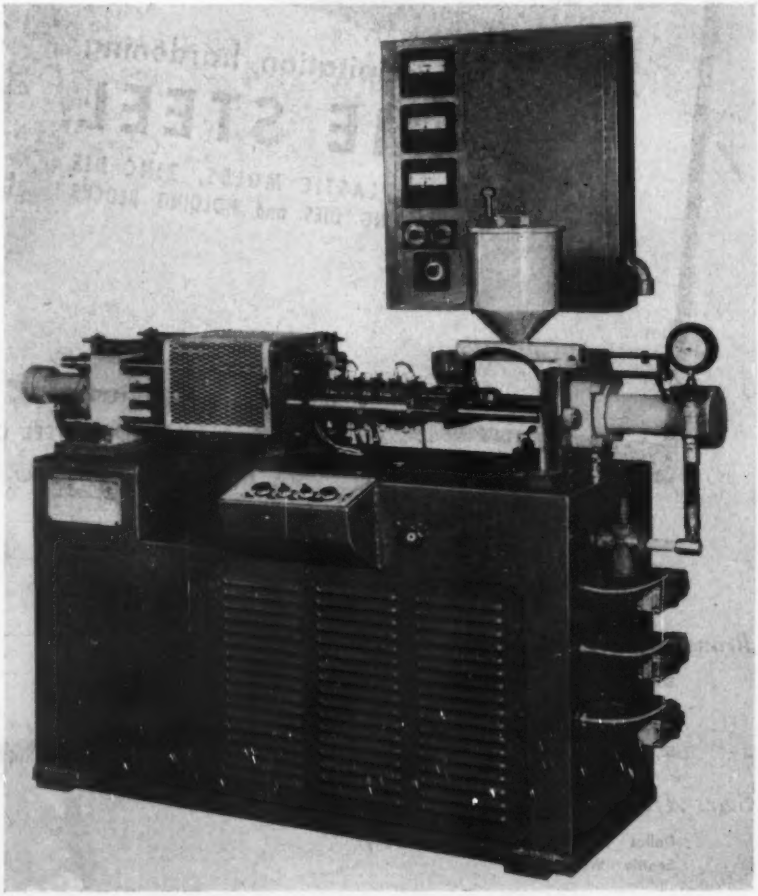
Three West Instrument Co. Gardsman proportioning instruments — one controls rear heat, one controls front, and one nozzle temperature.

Four timers control the time cycle — one Cycle-Flex timer for overall cycle, one Cycle-Flex timer for first injection stroke, one Micro-Flex Counter timer for stuffing, and one Allen-Bradley Repeat Cycle timer for fully automatic operation.

Specifications for the MODEL 73 are as follows:

Injection capacity per shot	2 oz.
Rate of injection (cu. in. of material/sec.)	3.92
Plasticizing capacity	25 lb./hr.
Cycles per hr., dry run	1200
Max. pressure on material at 1250 p.s.i. (on oil)	12,100 p.s.i.
Stroke of injection piston	7 in.
Mold clamping area	20 sq. in. plus
Mold size	8 by 9 in.
Minimum mold thickness	5½ in.
Max. mold thickness	8½ in.
Mold opening	6 in.
Space between clamp tie bars, vert.	5 in.
Space between clamp tie bars, hor.	8¼ in.
Injection cylinder heaters	2500 w.
Nose heater	225 w.
Operating temperature range	150 to 650° F.
Power consumption of heating unit when plasticizing to full capacity @ 220 v., 3 phase	8.4 amps
Maximum operating pressure of hydraulic system	1250 p.s.i.
Motor, 220/440/550/3/60	5 hp.
Floor space, length by width by height	78 by 28 by 44 in.

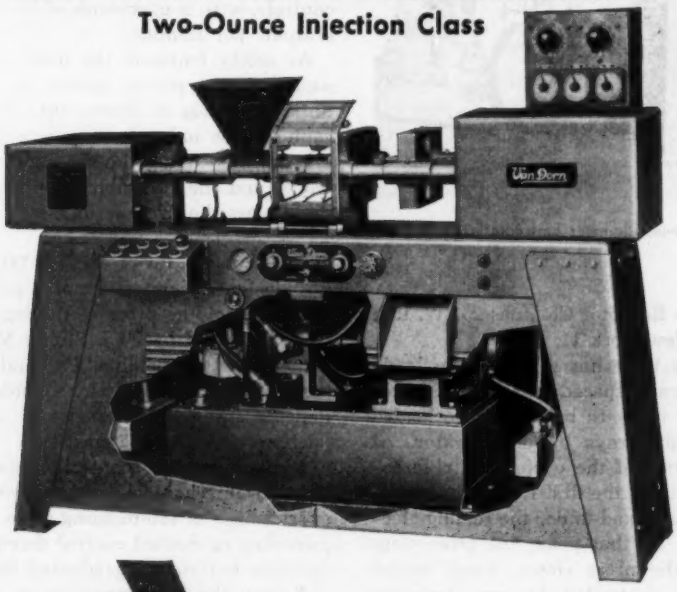
Vacuum Coater—A normal production rate of 4 cycles per hr., and of five cycles per hr. with base ma-



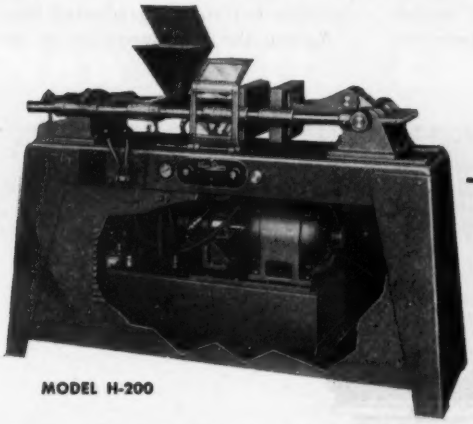
Model 73 Moslo 2-oz. injection machine has mold clamping area of 20 sq. in. plus

Produce Plastics Profitably With This
VAN DORN Equipment

Model H-200—Leader in the Semi-Automatic Two-Ounce Injection Class



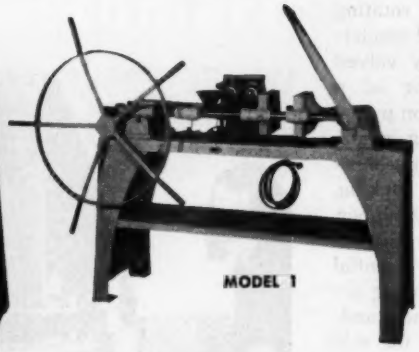
This ultra-modern press molds practically all thermoplastics including nylon. It completes up to 6 operating cycles per minute. Push button controls are safe, simple and convenient. Compact and rugged, the unit is quiet and economical in operation. Sliding gate with interlocking safety devices starts the cycle. Solenoid valves close the molds. Injection and dwell are controlled by first of three timers on the rear panel. Center timer regulates recharging of heater. The third timer controls the length of the mold close cycle; when time runs out, molds automatically open and parts are ejected. Operator opens safety gate, removes product and then closes gate to begin the next cycle . . . Variable voltage transformers in conjunction with thermostatic units control the temperatures on the two heating zones accurately.



MODEL H-200

Power Operated, Lever Controlled Presses

2-oz. or 1-oz. capacity. These low-cost units operate 8 hours for under a dollar and use inexpensive molds. Can easily be set up in twenty minutes by one man.



MODEL 1

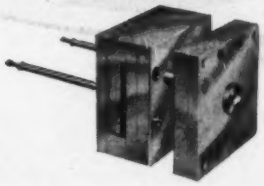
Manually Operated Press

1-oz. capacity. This press is ideal for smaller jobs, experimental work and technical training.

MODEL G-100

Plastic Grinder

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



Mold Bases

Available from stock for all Van Dorn presses.

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THE Van Dorn IRON WORKS CO.

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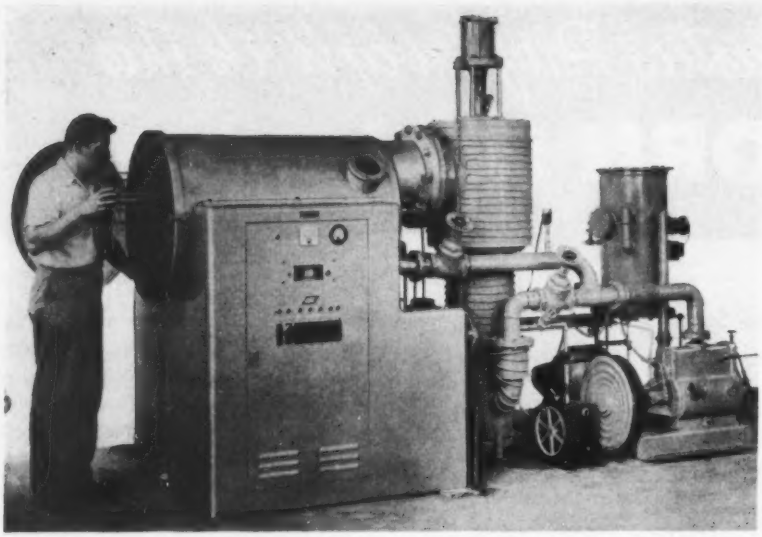
Cable Address: "VANDORN" Cleveland



Consolidated Vacuum's coating unit LCI-30 has 30-in. diameter horizontal chamber

terials of low volatile content, is achieved by vacuum coating unit type LC1-30, offered by Consolidated Vacuum Corp., 735 Ridge Rd., W., Rochester 3, N. Y.

Designed to meet the requirements of smaller metallizing companies, the equipment has a 30-in. diameter horizontal chamber complete with fixtures and filament holder. The chamber is mounted on a steel cabinet which contains the filament power supply, the fixture rotating motor, and a door-mounted electrical control panel. The fully valved pumping system, consisting of a high-speed 14-in. oil diffusion pump, a small mechanical holding pump, and a 100-cu. ft. per min. mechanical pump for roughing and backing, is located at the rear of the chamber.

The entire coating cycle is controlled from one point, all essential valves, controls, and gages being accessible to the operator as he stands before the viewing port in the side of the chamber.

The unit is supplied either with a stationary fixture for single-surface coating, or with two rotating fixtures, each of which holds 12 riser rods.

Sealing Equipment—For use in conjunction with any of the company's electronic heat sealing presses and generators, a newly developed turntable is said to make possible automatic sealing operations. The unit is offered by Thermatron Div., Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N.Y.

The table has a number of loading trays spaced around the outer edge; items to be sealed are loaded into the trays by an operator. At the start of the cycle, the table rotates until the first tray is automatically indexed under the sealing electrode. At that point, the table stops and the press closes, dwell period being controlled by an electronic timer. The press then opens, the turntable rotates until the next tray is indexed, and the cycle is repeated.

Controls consist of a cooling timer, indicator lights, and selector for manual, semi-automatic, or fully automatic operation. They are all mounted in a single box.

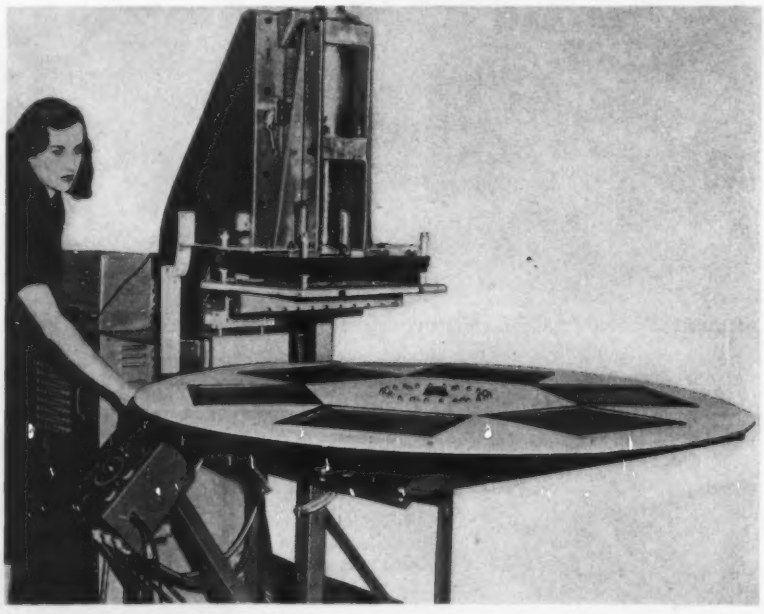
The table is available in sizes up to 60-in. in diameter, and is adjustable for 4, 6, 8, 12, and 24 indexes per revolution. Number of seals per minute is set by means of speed controls, with a maximum of 30 operations per minute.

As safety features, the unit is so designed that power cannot go on until the press is down; the press cannot close unless a tray is properly indexed under the sealing electrode; and the turntable cannot index unless the press is up.

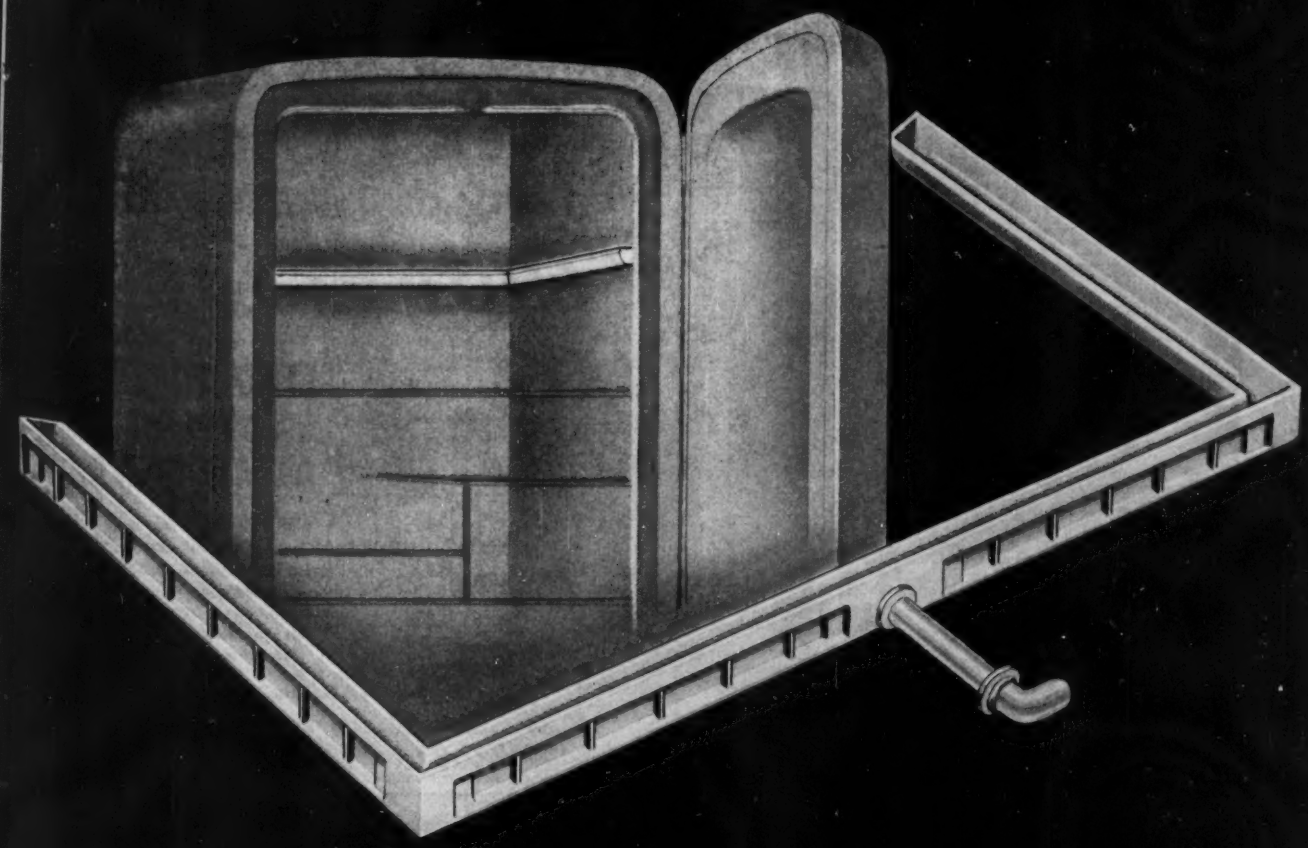
Compression Press—Model 731 is a redesigned semi-automatic compression molding press of the toggle type, produced by F. J. Stokes Machine Co., Philadelphia, Pa., and is particularly intended for molding delicate insert parts, resistors, capacitors, and similar items.

A patented bar controller gives positive mechanical control over every phase of the molding cycle by providing calibrated control through movable buttons on graduated bars.

Among the improvements on the



Thermatron's turntable makes possible automatic electronic heat sealing operation



New 4½ ft. "Elastomeric" Drain Rail

. . . molded in one piece by AMOS

Automatic refrigerator defrosting without work or worry . . . defrost water is *drained* and evaporated automatically . . . with this new 4½ foot flexible drain rail molded by AMOS.

One of the largest integral, injection molded parts ever made—the drain rail was developed in cooperation with Seeger Refrigerator Co., Evansville, Indiana—makers of Sears Roebuck "Super-Mart" refrigerators. The plastic used does not become hard and brittle with temperature changes—imparts no odor to stored foods—and is easily cleaned.

Despite its size and intricate shape, mold-making and molding costs were kept *low* by molding the drain rail "crooked with bends" and stripping it off the undercuts in the mold.

Why not apply similar AMOS experience and ingenuity to *your* plastic problems? You can depend on AMOS to do the *entire* job . . . *Right.* No obligation . . . *write, wire or phone:*

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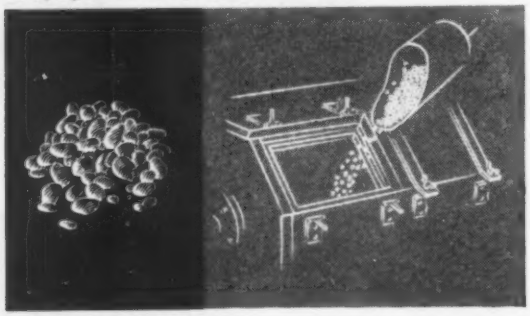
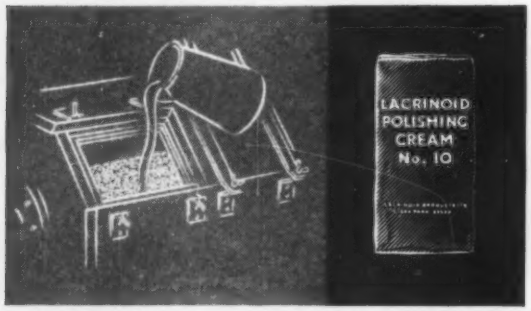
Ensure a finer finish faster

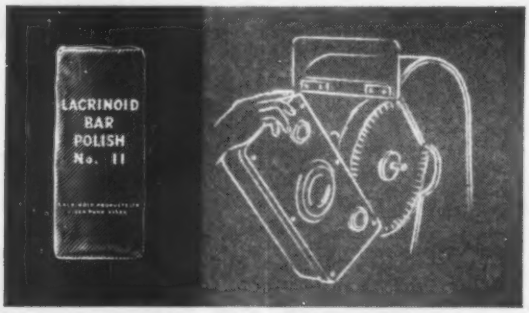
FINISHING GRANULES
for the barrel surfacing of plastics, and wooden parts. The granules are of porous stone impregnated with a special bonding and lubricating compound. Their use prevents formation of dust and protects the material from abrasions. The granules can be reimpregnated after a period of use.



POLISHING CREAM No. 10
for the barrel polishing of small and medium sized plastics objects. A lasting, brilliant lustre is imparted with great speed and with the very minimum of supervision.



BAR POLISH No. 11
performs simultaneously the functions of (1) abrasion, (2) finishing and (3) glossing. It is fast in action and not only saves time but results in considerable economies in the replacement cost of mops.



The services of the Lacrinoid Research Department are freely offered in any development of finishing and polishing techniques.

Apply for descriptive leaflets which give fuller details of above materials.

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LEAD SCREW TAPPING ATTACHMENT

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★ Less tap breakage.
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Models for various column and gib type drill presses.

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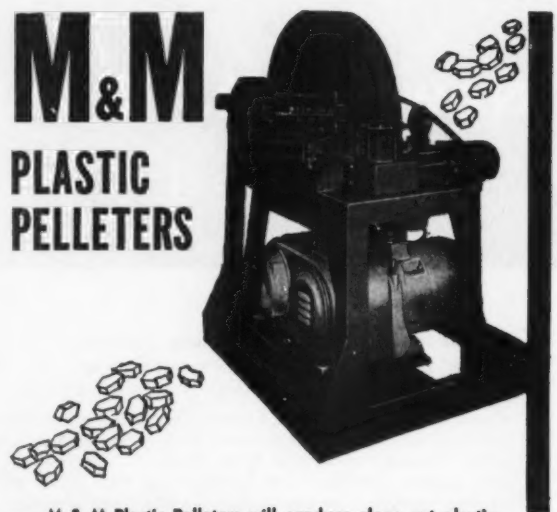
Elizabeth, N. J.

M&M PLASTIC PELLETERS



M & M Plastic Pelleters will produce clean cut plastic pellets that need no screening when cutting the product from extruder or compounding mill. A variable speed drive permits the Pelleter to be synchronized with the extruder or mill output. The M & M straight knife Plastic Pelleter will cut extruded plastic rods into pellets of uniform size and shape. The M & M notched knife pelleter will produce pellets of uniform size in a hexagonal shape from plastic ribbons up to 10" wide.
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redesigned press are the following: color-coded electrical circuits for easier maintenance, seamless steel tubing for all oil lines, larger platen area (24 by 24 in.), and wider spacing between tie rods.

A 3-stage automatically controlled closing action reduces closing time. On the initial ram approach, a regenerative circuit takes oil out of the top of the ram and feeds it back into the bottom, resulting in approximately double the normal approach speed. This approach speed is then cut to about 25% at a predetermined and adjustable point; the intermediate speed is further reduced to a final closing speed as mold pressure builds up.

Counterboring Tool—Of interest to mold makers is a new series of ejector pin counterbores, offered by Detroit Mold Engineering Co., 6686 East McNichols Road, Detroit 12, Mich.

These tools provide a 45° chamfer for the radius under the ejector pin head as it counterbores for the head diameter, making chamfering operations after counterboring unnecessary. Twenty-seven different size counterbores are available for ejector pins ranging from 3/32 to 3/4 in. in diameter.

The pilot on each of the counterbore sizes is ground for a slight slip fit of 0.002-in. clearance on the diameter of the hole. This provides for a more concentric cutting action. The counterbore diameter itself has been designed to give a minimum of 0.014-in. clearance for the head diameter of the ejector pin. A three-flute spiral has been incorporated in the design to give rapid chip clearance.

Hydraulic Press—Designed for both laboratory and production use where controlled heat and pressure are required, new small, compact hydraulic press accommodates 12- by 12-in. platens. It is manufactured by Atlas Hydraulics, Inc., 3576 Ruth St., Philadelphia 34, Pa.

The press is electrically heated and air operated. Each unit is equipped with individual controls which make it possible to regulate hydraulic pressure for each operation with the touch of a finger, within a range of 50 to 4000 p.s.i., the hydraulic pressure aggregating approximately 55 tons capacity.

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"British Empire Trades Index"

Published in 1953 by Business Dictionaries Ltd., 133, Fetter Lane, London E.C. 4, England. 1138 pages. Price 30 *s* (ca. $5.20).

The 22nd revised edition of this classified index gives names, addresses, and trade of firms in the British Empire which buy and sell, or provide transport facilities, insurance, and financial and other necessary services in connection with trade and commerce. It is divided into five sections, as follows: 1) trading concerns arranged alphabetically under their respective classifications; 2) an alphabetical index, by name, of all firms appearing under the respective trade classifications in the preceding section; 3) list of trademarks and brands; 4) an alphabetical index of overseas cable addresses; and 5) United Nations section, listing firms not located in the British Empire.

"Matieres Plastiques," by M. Fournier, et al.

Published in 1953 by Presses Documentaires, 28, Rue Saint-Dominique, Paris (7e), France, for Centre Technique D'Enseignement Ouvrier. 304 pages. Price 1500 F. (ca. $4.25). In French.

A series of lectures given by the authors (14 French engineers working in both private industry and government) to students at the *Centre Technique D'Enseignement Ouvrier*, is presented in this volume. The scope is the coverage of the major plastics materials, their characteristics and applications, with one chapter devoted to molding, calendering, and related processes. The materials discussed include casein plastics, cellulosics, vinyls, acrylics, phenoplasts and aminoplasts, polyethylene, styrene, silicones, and polyamides. There are also sections on laminating and synthetic fibers. Each chapter describes the manufacture of the material, its properties, and its uses.

Rubber compounds—Three bulletins give formulas for the production of GR-S compounds. Bulletin C-11 presents three formulas by which rubber shoe sole compounders can obtain high quality, low cost sole stock. Bulletin C-12 points out the cost advantages afforded by oil extended polymers. Bulletin C-13 covers the use of GR-S "cold" rubber with the company's copolymer 43G. *Dewey and Almy Chemical Co., Organic Chemicals Div., Cambridge 40, Mass.*

Hydraulic equipment—A complete line of hydraulic cylinders, valves, pumps, motors, power units, and accessories is detailed in a group of individually bound catalogs, as follows: *601*—pumps, motors, power units, and accessories; *701*—150 p.s.i. air or 300 p.s.i. oil hydraulic cylinders; *721*—2000 p.s.i. cylinders; *741*—3000 p.s.i. cylinders; *801*—2000 p.s.i. valves, sub-plate connections; *901*—Accessories, *1001*—Engineering manual. *The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

Silicones—The 1953-1954 reference guide to the company's silicone products includes 15 new developments, ranging from adhesives to molding compounds. New applications for silicone fluids are detailed, and the performance of Silastic as a dielectric is described. In order to make the guide more useful to the design engineer, a cross-reference application index has been included. *Dow Corning Corp., Midland, Mich.*

Polyesters—Complete technical and application information on a family of clear, transparent, liquid polyester resins suitable for laminating, impregnating, molding, casting, and protective coating is furnished in this 75-page booklet entitled "Glidpol Resins." The specific topics discussed include: laminating, molding, casting, potting, storage stability, catalysis, reinforcement, and coating. An extensive section of appendices lists physical and chemical properties of each one of the polyester resins offered by the company. Formulations for various applications, step-by-step operational procedures, and safety measures to be used in handling the material are given. *The Glidden Co., 11001 Madison Ave., Cleveland 2, Ohio.*

Air conditioning—Technical papers presented during a conference on Year-Round Residential Air Conditioning, held at Lehigh University, are presented in this volume. Among the topics covered are technical aspects of modern residential construction, a review of the research program conducted by the American Society of Heating and Ventilating Engineers, load calculation for residences, problems of control and operation of air conditioning systems, and a review of research work done at the University of Illinois. Price $6.00. *Dept. of Mechanical Engineering, Lehigh Univ. Bethlehem, Pa.*

Reinforced plastics—Proceedings of the 8th Annual Technical and Management Conference of the Reinforced Plastics Div. of The Society of the Plastics Industry, Inc., contain the reports and papers presented at that meeting and the discussions and comments which followed their presentation, as well as a record of the forum and panel discussions which took place there. The subjects encompass the entire field of reinforced plastics, covering new developments in raw materials (resins and fibrous reinforcements), equipment, presses, and molds, applications (Coast Guard, aircraft, ships, Signal Corps, ordnance, etc.), adhesives, finishes, laminations, and so forth. These proceedings constitute an excellent portrait of the reinforced plastics industry today, its achievements, its problems, and the directions in which it is moving. Price $3.00 plus postage. *Reinforced Plastics Div., The Society of the Plastics Industry, Inc., 67 W. 44th St., New York, N.Y.*

Monomer—Applications for the company's new monomer vinyltoluene in the paint and varnish field are outlined in this 47-page technical data bulletin. Presented are details on the monomer's reactivity with all of the most commonly used commercial vehicle oils, on its ease of reactivity, and on the solubility of the products in aliphatic hydrocarbons. The bulletin also describes a completely new

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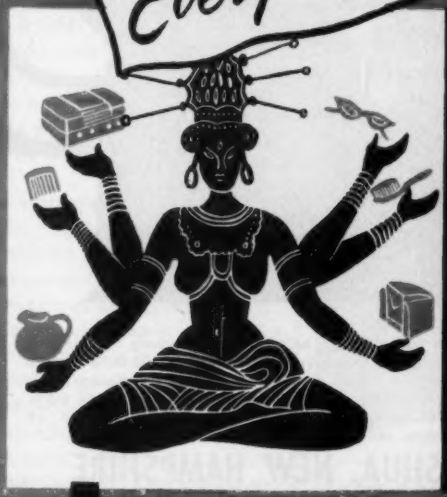

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The rich appearance and beauty of molded items made from Gering Special Effects Molding Powders are unsurpassed. It would pay you to investigate the sales potentials which special effects in Polystyrene, Polyethylene, Cellulose Acetate, Vinyls and Acrylics can accomplish for your products.

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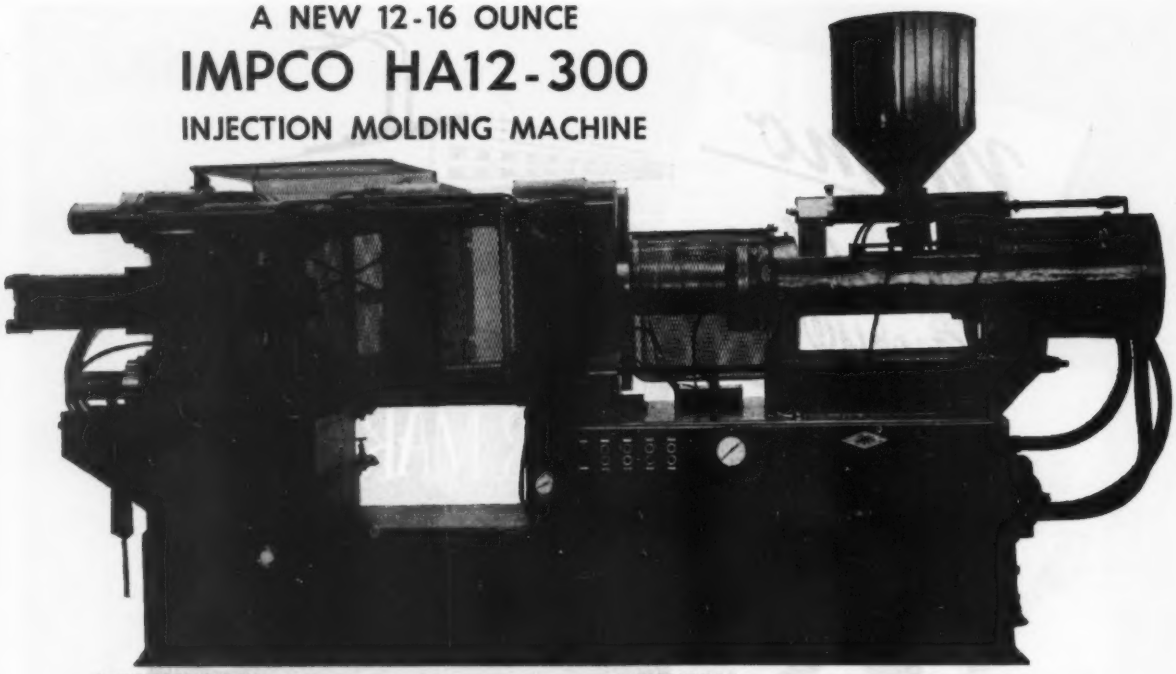
A NEW 12-16 OUNCE

IMPCO HA12-300

INJECTION MOLDING MACHINE



SPECIFICATIONS:
Injection Capacity—12 Ounces
Injection Pressure (Plunger)—22,400 lbs. p.s.i.
Clamping Pressure—300 Tons Stroke—12½"
Mold Space (Between Tie Rods)—16" x 19¼"
Machine to Cycle (Dry Run)—6/minute
Dimensions—173" long—50" wide—86" high

FEATURING:
A high plasticizing, adjustable prepacking, positioning injection unit. Improved two pressure hydraulic system and electrical circuit in utilizing modern techniques. Large free area under platens with accessibility to all parts. Separate control panel, automatic lubrication and oil temperature control.

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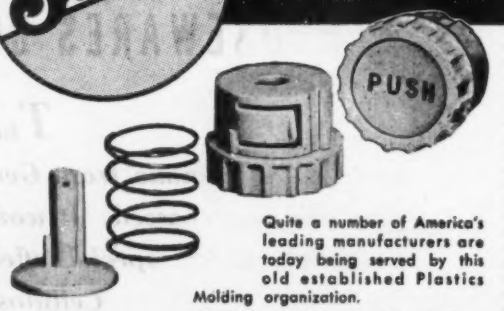

Quite a number of America's leading manufacturers are today being served by this old established Plastics Molding organization.

And typical of the many fine products Sinko makes for them is the Defroster Push Button Assembly (and its components) here pictured. This and other important items, including Vegetable Crispers, Butter Storage Units, Sterile Lamp Guards, Knobs, etc., are being fabricated for the 1952 Admiral Refrigerator.

Sinko molds all thermoplastics, including Nylon; and has complete facilities for design and engineering, mold making, metal-plastic fabricating, 2 and 3 color plastic spraying, hot stamping, and assembling.

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class of vehicles which are interpolymers of vinyltoluene and drying oils with divinyl-benzene; it also contains a section on the uses of the new monomer in enhancing alkyd resins. *Coatings Technical Service, The Dow Chemical Co., Midland, Mich.*

Clear cast sheet—A line of optically clear rigid plastics sheets, including three thermosetting and two thermoplastic types, is described in this 12-page catalog. Also provided is information on applications and fabrication, a table which lists properties for each type of cast sheet made by the company, and data on standard sizes and thicknesses in which the sheets are available. *Cast Optics Corp., Riverside, Conn.*

P.V.A.—Information on physical properties, applications, handling, and storage for the company's Vinac polyvinyl acetate emulsions (used in the production of adhesives, as binders, coatings, paint bases, and in the textile field) is given in this booklet. Recommendations for compounding with these emulsions cover plasticizers, compatible resins and extenders, thickeners, solvents, and acids. *Colton Chemical Co., 1545 E. 18th St., Cleveland 14, Ohio.*

Cellulosic—Revised edition of this technical booklet details new information about applications for the company's technical grade sodium carboxylmethylcellulose, a water-soluble cellulosic used in wallpaper adhesives, synthetic detergents, and other laundry products. Data on water solubility, suspending power adhesive properties, and film-forming properties are also included. *Hercules Powder Co. Inc., Wilmington, Del.*

Product listing—The various vulcanized fiber, laminated, and reinforced plastics items manufactured by the company—ranging from advertising novelties and specialties to trucks—are enumerated in an alphabetical 8-page listing. *National Vulcanized Fibre Co., Wilmington, Del.*

Coatings—Applications of ethyl cellulose in specialty coatings on other plastics, rubber, metal, wood, and paper surfaces, as well as its use as a base for many liquid adhesives, strippable protective coatings, and gel lacquers are discussed in this technical booklet. Starting formulations

Furnished in rolls or sheets as specified

...a tougher industrial paper with glass-fibre reinforcement built-in... not laminated!

Tough Mosinee SCRIMTEX is *better* for many industrial uses because:

1. Glass-fibre reinforcing scrim is embedded or "built-in" as part of the paper itself.

2. No adhesives or binding agents needed, as in laminated papers.

3. In the laminated plastics industry, unusual properties have been obtained with SCRIMTEX, especially in edge-impact tests.

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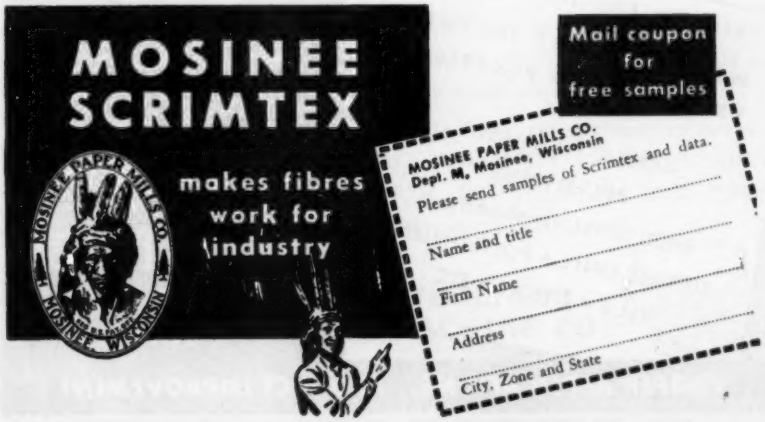

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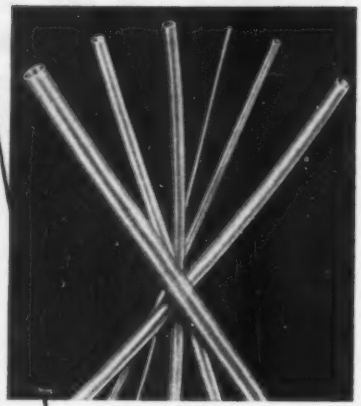
H & R Polyethylene tubing is specified by America's leading pressure package manufacturers. Only 100% virgin material is used. Blends available to suit your particular needs. All tubing held to close tolerances within your requirements . . . custom dies made to your specifications.



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Available plain or gusseted, in widths from 2" to 38" and in thicknesses from .00125 to .006. A trial will show you why so many leading packaging firms call on H & R for all of their flat packaging needs.

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PROPER APPLICATIONS...PRODUCT IMPROVEMENT

and information about solvents and stabilizers used in ethyl cellulose coatings are also included. *Hercules Powder Co. Inc., Wilmington, Del.*

Test equipment—Illustrated with application photographs, concise buyer's guide for testing instruments (GEA-5496B) lists a family of electrical testing apparatus, including hook-on voltmeters, hook-on wattmeters, pyrometers, surface roughness scales, phase sequence indicators, and others. Specifications and application notes are listed for each piece of apparatus. *General Electric Co., Schenectady 5, N. Y.*

Fibrous glass—Results of tests conducted to determine the comparative wet strength properties of plastics laminates reinforced with fibrous glass treated with Garan and two other finishes is summarized in this 8-page booklet. *Libbey-Owens-Ford Glass Co., Fiber-Glass Div., Toledo 3, Ohio.*

Tableting equipment—Detailed description of the company's punch and die plant operation are contained in this 4-page folder. It particularly indicates the degree of quality control applied at each step of production, from punch hobbing to finishing. *Arthur Colton Co., Div. of Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.*

Solvent—Technical data sheet No. 20 deals with two grades of ethyl acetate marketed by the company. The first, containing 85 to 88% ester, is used for solvent and manufacturing purposes, the second, 99 to 100% grade, is available for those applications where the presence of 12 to 15% ethyl alcohol is undesirable. The data sheet furnishes information on specifications, properties, uses, toxicity, shipping, handling, and storage. *Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.*

Research—Results of a survey conducted by the U.S. Dept. of Labor in cooperation with the Dept. of Defense on scientific research conducted by American industry is presented in 106-page Bulletin 1148. The data presented (both in descriptive-interpretive and in tabular and graph form) include information on the following topics: distribution of research engineers (by industries), re-

search engineers and scientists as percent of total employment, ratios of supporting personnel to research scientists, distribution of research cost (by industries) research financed by Federal Government, research cost as percent of sales, cost per research engineer, turn-over of professional research staff, and others. Price 50¢. *Supt. of Documents, U. S. Govt. Printing Office, Washington 25, D. C.*

Synthetic organic chemicals—The 1954 edition of the perennial "Physical Properties of Synthetic Organic Chemicals" again presents data covering the most important physical properties of a line of chemicals. This edition, Booklet F-6136, lists more than 330 compounds and includes 36 new chemicals. The chemicals are arranged by family groups, with condensed application data given for each family. *Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y.*

Chemical products catalog—Latest prices for carbon blacks for plastics, paint, paper, rubber, and ink (both channel and furnace), as well as quotations for charcoal, coke, wollastonite, garnet aerosil, several plasticizers, and pine tars, oils, and solvents are presented in this 7-page booklet. *Godfrey L. Cabot Inc., 77 Franklin St., Boston 10, Mass.*

Vinyl fabric—Simplified outline of production steps involved in the manufacture of Wataseal, an unsupported vinyl film fabric for use in a large variety of consumer applications, is presented in this 16-page booklet. Notes on the company's personnel, equipment, and promotion efforts are also included. *Harte & Co., Inc., 267 Fifth Ave., New York 16, N. Y.*

Shipping containers—Directory of steel shipping container manufacturers provides product-manufacturer cross-references and addresses for manufacturers' plants and offices. Also included are statistics on annual production of various container types and their uses by industries, historical material, general information on container specifications, and recent developments in exterior and interior coating research. *Steel Shipping Container Institute, Inc., 600 Fifth Ave., New York 20, N. Y.*

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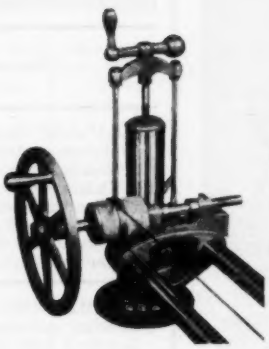
Low Cost - Accurate Long Rail Panel Saw



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Cuts large sheets of plastic, plywood, and metal for all fabricating jobs. One operator activates saw across panel by handwheel on drum cable. Greatly improves accuracy and speed. Rigid rail mounts permit large sheets to be held in firm cutting position. Cut is carried downward, producing a clean finish. Saw can be tilted with rails 90° for rabbiting and mitering. Saves considerable handling — reduces all cutting costs — gives accurate cut on all large panels. Available in 6', 8', 10', and 12' long rails. Many of these MLR long rail panel saws are in use today.

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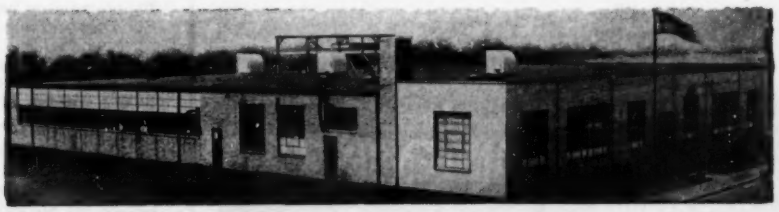

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant, for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials
CELLULOSE PLASTICS:[a]
Cellulose acetate and mixed ester:
Sheets, under 0.003 gage
Sheets, 0.003 gage and over
All other sheets, rods, and tubes
Molding and extrusion materials
Nitrocellulose sheets, rods, and tubes
Other cellulose plastics
PHENOLIC AND OTHER TAR-ACID RESINS:
Molding materials[a]
Bonding and adhesive resins for—
Laminating (except plywood)
Coated and bonded abrasives
Friction materials (brake linings, clutch facings, and similar materials)
Thermal insulation (fiber glass, rock wool)
Plywood
All other bonding and adhesive uses
Protective-coating resins, unmodified and modified except by rosin
Resins for all other uses
UREA AND MELAMINE RESINS:
Textile-treating and textile-coating resins
Paper-treating and paper-coating resins
Bonding and adhesive resins for—
Plywood
All other bonding and adhesive uses, including laminating
Protective-coating resins, straight and modified
Resins for all other uses, including molding
STYRENE RESINS:
Molding materials[a]
Protective-coating resins, straight and modified
Resins for all other uses
VINYL AND VINYL COPOLYMER RESINS, total[b]
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for—
Film (resin content)
Sheeting (resin content)
Molding and extrusion (resin content)
Textile and paper treating and coating (resin content)[c]
Flooring (resin content)
Protective coatings (resin content)
All other uses (resin content)
All other vinyl resins for—
Adhesives (resin content)
All other uses (resin content)
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:
Molding materials[a,d]
Protective-coating resins[e]
Resins for all other uses[f]

* Dry basis is designated unless otherwise specified.
** Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR AUGUST AND SEPTEMBER 1953 by U. S. Tariff Commission

August		*September*	
Production	*Sales*	*Production*	*Sales*
1,160,741	1,282,242	1,557,083	1,634,144
1,225,517	1,144,129	1,295,161	1,335,382
461,898	447,021	535,168	517,090
6,259,087	6,138,392	7,393,023	7,534,182
596,559	497,015	644,255	536,032
448,623	557,285	427,069	434,492
**18,174,461	**15,075,231	19,147,823	17,646,575
**5,537,927	**4,137,838	6,882,093	4,333,978
1,153,056	870,449	1,107,993	1,024,327
1,625,479	1,303,877	1,712,890	1,298,382
1,569,894	1,433,258	1,327,482	1,550,264
2,858,062	2,694,683	2,868,088	2,568,080
1,535,893	1,420,689	2,750,983	2,705,154
**2,272,904	**2,038,055	2,168,689	1,900,408
**2,843,770	**1,912,405	2,468,493	2,070,077
2,156,775	2,475,645	2,349,445	2,289,019
1,786,894	1,698,610	1,818,534	1,726,037
4,221,509	3,935,622	4,183,464	4,045,903
2,852,103	3,128,203	3,067,460	3,250,670
2,224,768	1,762,403	2,407,923	1,980,864
5,329,792	4,949,814	5,591,144	5,085,894
**32,108,526	**22,535,545	25,356,358	25,181,589
**6,528,195	**6,144,643	7,565,277	8,349,473
6,563,223	5,106,702	7,140,530	5,751,320
43,591,858	36,180,124	40,381,397	38,066,365
—	4,903,454	—	5,317,708
—	4,608,666	—	4,854,987
—	8,650,088	—	9,484,871
—	3,850,894	—	4,281,316
—	2,062,654	—	2,072,678
—	1,850,116	—	1,947,512
—	2,412,019	—	2,283,626
—	1,720,878	—	1,999,628
—	6,121,355	—	5,824,039
13,671,774	12,312,365	14,337,461	15,023,609
10,472,827	10,049,518	13,095,290	11,637,410
604,672	403,164	638,121	397,711
8,795,028	9,503,109	8,959,452	9,832,137

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [f] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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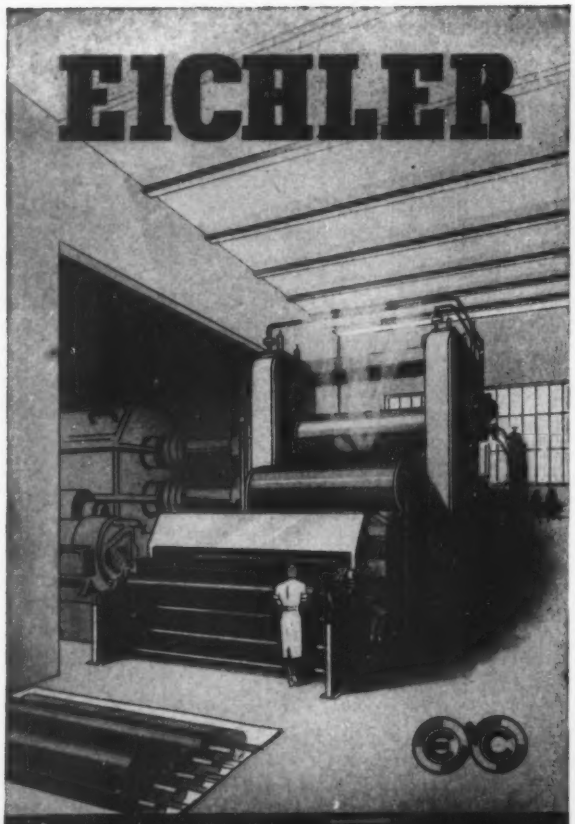

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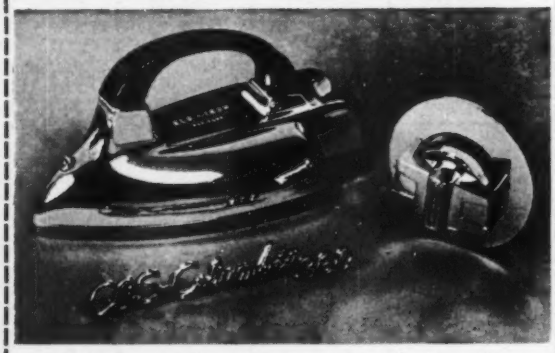

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Phenolics

(*Continued from p. 69*)

ing and laminating material have so many uses that a big catalog would be needed to describe them in detail. Unlike the molding branch of the industry, this miscellaneous group has come up with something new every few months. Many of them look highly promising and then die on the vine. Latest news is about micro-balloons—tiny nitrogen-filled globules of phenolic used to prevent evaporation in certain phases of the oil industry. Widespread use of these micro-balloons will reportedly save the petroleum industry 60 million dollars a year. The application is still too new to evaluate future growth potential.

Largest volume of any single phenolic resin in the miscellaneous group is for use as a binder for mineral wool in thermal insulation. Between 26 and 30 million lb. of resin were consumed for this purpose in 1953. And growth continues with the ultimate possibilities not yet in sight. One plant reportedly shipped as much as 100 freight car loads a day of glass wool in 1953 for this purpose. Glass wool uses are extending from home and refrigerator insulation to such things as packaging for delicate instruments, stuffing for cushions and upholstery, and an unbelievable assortment of things. Resin content is from 4 to 8% as a rule—sometimes higher. It is possible that very few analysts have allocated enough resin for this application in the years to come when they try to guess the future course of the phenolic industry. The mineral wool people simply don't tell how good their business has become. On the other hand, the resin people say it is a very low profit business—too competitive.

Resin used for brake linings, clutch facings and other friction materials may have reached a 15 million lb. or more volume in 1953. Resin for grinding wheels, sandpaper and other abrasives approximated 12 million.

Shell Molding

Most talked about of all the phenolic bonding resins was that used in the foundry industry for shell molding, but the total probably didn't exceed 9 or 10 million lb. in

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offers
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Molders of Plastics for over a Quarter Century

1953. Consumption in 1951 was about one million lb. and a little over 3 million in 1952. Producers are hopeful that consumption will reach 50 million lb. by 1957.

The year of decision as to shell molding's future will probably come about 1955, by which time there will have been enough companies using it to determine how far it will penetrate into the foundry works. Development is slow on the part of large companies because it costs hundreds of thousands of dollars to change over to shell moldings. One automotive company is reported to have spent 1½ million dollars in tooling up for the changeover. Some of the auto companies prefer to forge rather than cast and may never change over. Other companies may make only a partial changeover to phenolic shell molding and may use the method only for precision work. It doesn't seem likely that small runs of large rough castings will ever go to shell molding or even to small castings produced in large volume where finishing costs are low, because conventional molding methods already have been highly mechanized. Then again it is possible that resin percentage in the sand will be reduced eventually. And there are now experimental projects under way for coating rather than impregnating the sand which would make more efficient use of the resin and require less volume.

All these possible happenings do not mean that the phenolic industry is discouraged about future use of resin in shell molding. Everyone expects a good increase but the astronomical growth figures commonly used a year or so ago must be taken with a grain of salt. And again it should be pointed out that the resin used is a low cost material and already subject to severe competition by many producers who are seeking to obtain a foothold in the market.

Waste Wood

Phenolics used for bonding waste wood are in another branch of the miscellaneous group that haven't yet lived up to volumewise promises, but which seem almost certain to continue increasing for an indefinite period of time. Urea offers stiff competition since it is less costly and has more color possibilities. However, urea bonded waste wood is not often recommended for exterior use where phenolics have full sway.

One producer claims that as much as 12 million lb. of phenolics were used for waste wood bonding in 1953. He points out that waste wood is rapidly becoming a replacement for higher priced plywood and is also developing into markets as a core or inexpensive backing for melamine sheets in furniture and other wood working industries. There are many handicaps, such as location of waste wood material and difficulties in making its virtue known to potential customers, that have held up the growth of this industry. However, it seems like a most logical development whose applicability must certainly win consumer approval at some future time.

Only a gradual increase in resin use for waste wood is expected in the next year and urea may get the biggest share. Several years may be required before the waste-wood industry ever reaches that 30, 40, or 50 million lb. resin usage which has been frequently predicted.

Another miscellaneous use that has been quiescent for several years returned to at least a more talked-about stage in 1953. That was phenolic-resin paper honeycomb. The aviation industry is promoting it as a core or sandwich material and the aluminum industry seems particularly interested in its use as a structural material that would incorporate honeycomb as an interior core for two skins of aluminum to form a structural panel. It looks like another highly practical application whose future is only dependent upon how soon the public becomes better acquainted with its possibilities.

There are many more miscellaneous types of phenolic resin—in some respects they represent one of the most challenging aspects of the plastics industry. Managers who worry about possible over-supply of phenol and formaldehyde in view of that 630 million lb. phenol production scheduled for 1955 may well concentrate on watching developments in this so-called miscellaneous branch of the phenolic resin industry. It is exciting, unpredictable, and likely to break through for a touchdown any minute.

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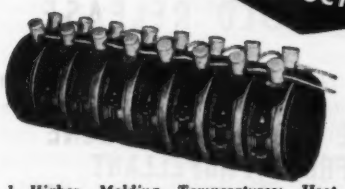

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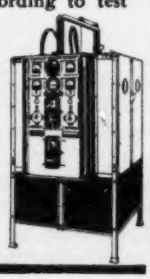

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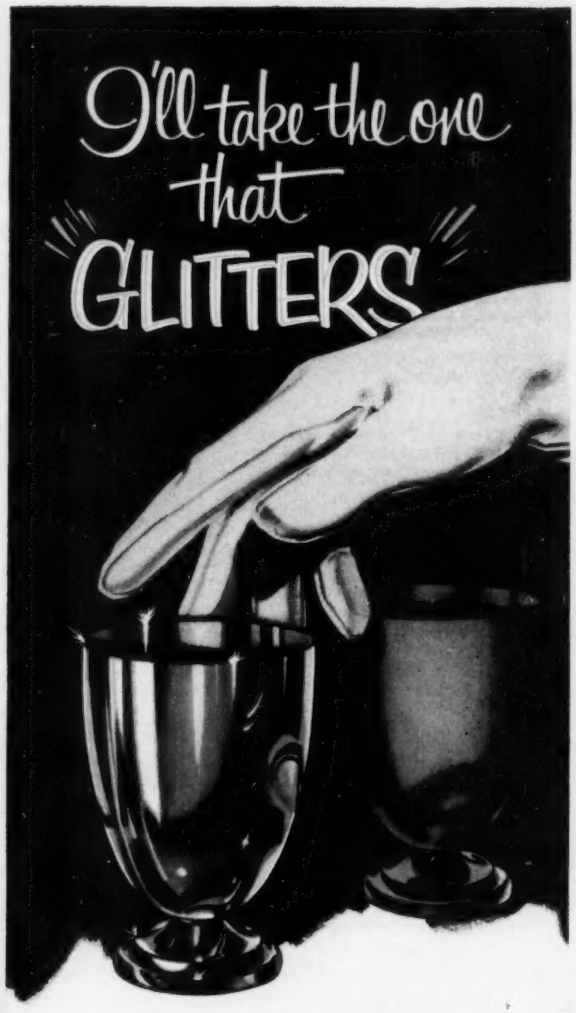

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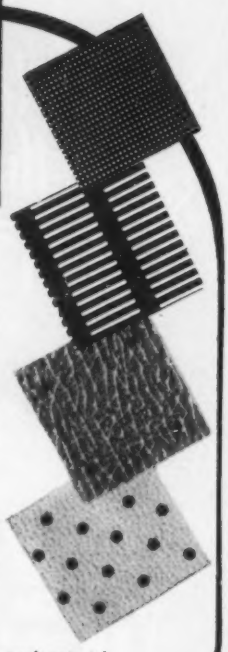

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Urea, Melamine

(*Continued from p. 70*)

gives the needed color. Only about ⅛ lb. of melamine is used to every pound of phenolic varnish; consequently, a great quantity of laminate is required to boost melamine sales very much. Nevertheless, this is one of the most optimistic situations in the melamine outlook.

Another item in the miscellaneous list is urea for foundry cores. Ureas are used for metals which are poured at low temperatures and phenolics for those metals poured at high temperatures. These resins are used for the inner core of a casting mold and should not be confused with the shell mold resins. Not much over 10 million lb. of resin is used for core molds, but the division between urea and phenolic has not been disclosed. The growth of resins for sand cores has been steady but not spectacular.

Still another unknown factor is the amount of urea resin used for wood waste. Apparently it has been included by reporting companies in various categories in the urea table. It is not believed to total more than 4 or 5 million lb., but is growing in use wherever the bonded wood panels can be used indoors for such things as doors, table tops, and cores. One manufacturer is using a urea-bonded waste wood for molded toilet seats that may then be painted or covered with nitrate sheet. Good success is reported for this application.

Adhesives

Urea adhesives or glues are used almost entirely for hardwood plywood and furniture. Consumption does not make for a prosperous industry from a profit viewpoint because of the low selling price. There is a great difference of opinion as to how urea adhesives fared in volume production in 1953, but most producers think the total will be several million lb. under 1952. One reason is that over 8 million lb. were used in December 1951 because a price advance had been announced to take effect in January 1952; customers filled up their inventories. Ordinarily, sales are between 6 and 7 million lb. a month.

Increasing use of urea glue depends upon the growth of the hardwood plywood industry, and perhaps it can also move into greater volume use in interior softwood plywood. In the latter case, it will have to supplant the less costly soybean glues. In hardwood plywood there is a good chance of increased volume, for this product has by no means reached its potential volume in American industry.

An important change in ownership took place in the urea industry last year when the Barrett Div. of Allied Chemical & Dye Corp. bought the Plaskon Div. of Libbey-Owens-Ford. Allied is also a new producer of urea crystal which is used in the manufacture of molding material and other urea resins. Until this plant came in, the industry had only one source of supply for urea crystal. A third supplier of crystal will soon come in—Grace Chemical Co. Urea crystal can also be used in cattle feed and in fertilizer.

The new producers of urea crystal have let it be known that they are not expecting any sudden, great expansion in the urea resin industry to absorb any unusual quantity of raw material.

Cellulosics

(*Continued from p. 72*)

super markets and industrial plants. These markers are circular in design with 4 to 6 pieces molded from each pound of molding material. They last indefinitely and save the maintenance cost of painted lines. New York City is trying out 300,000 such markers. Washington, D.C., is using them in front of the Capitol Building. Several million of them should be in place by the end of 1954.

Pipe

Among the brightest prospects for butyrate is pipe used for conducting petroleum, natural gas, and water. Several utility companies have reported satisfaction with butyrate pipe after several years' trial. They use it primarily for conducting gas from the main to the house. Petroleum companies are using it for carrying oil that has a high paraffin content because the parafin does not stick to the side walls of butyrate pipe and cause clogging. Other oil companies are trying it out for carrying off salt water from their separator tanks. Butyrate water pipe is practical in water systems where pressure or heat resistance requirements are not too high. However, it is not recommended where chlorine is present in the water. Butyrate syphon tubes have been used in irrigation fields for several years, and in Australia butyrate pipe is sought for all varieties of farm and irrigation applications. Something like 3½ million lb. of butyrate is thought to have been used for pipe in 1953, and that volume is expected to double in two or three years' time.

Butyrate film has already won acceptance as a superior material for voice recording machines, although there is some question as to how much farther it may expand in this field. Clear, transparent butyrate sheeting for vacuum forming looks like a material with a magnificent future—perhaps one of the most significant butyrate developments in recent years. Its cost is reasonable compared with other types of sheeting, and its transparency, printability, and toughness are such that several prominent vacuum molders are unusually enthusiastic about its possibilities.

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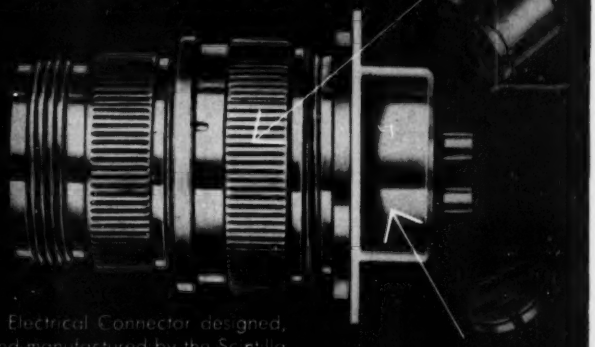

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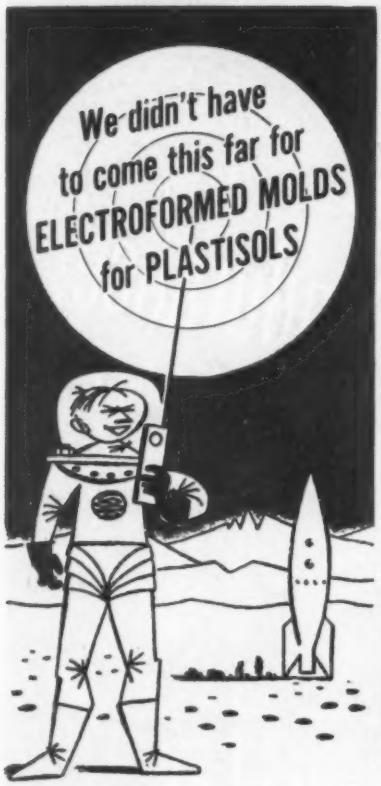

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Vinyls

(*Continued from p. 75*)

states that maybe the fickle housewife wants to try out the new bark cloth and unwoven rayon drapes before she returns to vinyls.

At any rate, it behooves the industry to expand other outlets than drapes and also to seek new markets. It is doubtful that the rainwear market, for one, has been exploited to its full potential, although it consumed an estimated 12 million lb. or so of film in 1953. The money value of the raincoat market is reported to have dropped from $165 million in 1946 to $125 million in 1953.

A new vented vinyl film for raincoats was introduced in 1953 amidst loud complaints from competitors that it would leak—but already six competitors of the original producer have entered the field! The first raincoat producer using this film met the criticism by placing solid vinyl film in the shoulders of his garment and vented vinyl in the balance to permit air circulation. Vented film is also recommended for furniture slip covers, mattress covers, pillow covers, and baby pants.

Markets for Expansion

Raincoats are only one segment of the vinyl film market that may be expanded. Covers for appliances and business machines are expected to increase steadily in popularity. Yard goods were down in 1953 but could go back up with more promotion effort. Tablecloths, aprons, and chair cushions were also off in 1953, but better designing and more individuality could bring them back up. The shower curtain market has leveled off and other materials, such as taffeta, have again entered the field, but this is an almost ideal market for vinyl that should not suffer too much from competition.

A promising new field is in agriculture where vinyl film is being tried for covers over cotton bales, for trench silos, as shade covers for greenhouses, and as tarpaulins for all sorts of outdoor needs.

Film or Sheet?

When referring to the resin-for-film figures (Table E), it should be remembered that a portion of the material listed is used for the type of so-called rigid vinyl sheeting less than 10 mils thick from which maps are made. But a big portion of the rigid sheeting is used for instruments, templets, and gridwork for fluorescent lighting. This latter application has been steadily growing for several years; 20- to 30-mil pressed and laminated sheets are generally employed.

Solvent cast vinyl is also in this film category, but there was no unusual growth in 1953. Storm windows were perhaps the largest outlet, with the very thin film going into some packaging uses. High grade appliance covers made from cast film became popular because of their toughness and transparency. Cast vinyl film is beautiful, strong, and clear. It seems strange that more volume has not been produced despite its higher cost. It has possibilities for greater expansion, but no one has yet found the key to a mass market for this splendid material. Cast plastisol film also, for one reason or another, has not yet come into very wide use.

Experimenters are still working with 1- or 2-mil extruded film, but there is very little of it on the market. The technique has not yet been perfected. Developers hope that 1-mil extruded film will make a dent in the packaging market where it could compete with other films on a price basis because its strength would permit use of a thinner film in the heavier wrappings needed for such things as apples, potatoes, and citrus fruit.

The dispersion and solution-type vinyl chloride used for paper and protective coatings continued to show normal growth in 1953. Vinyl-coated paper developed for shelf covering is now being used also for low-cost wall covering. Paper milk bottles with vinyl coating are continuing to take over a larger share of this 20 billion quart package market. About 40% of all milk containers are now believed to be paper. Vinyl can coatings, particularly for beer, grow larger each year and the use of vinyl for anti-corrosive paint is a constantly growing market. Vinyl sprays for protective uses showed a good increase in 1953. Vinyl chloride latex is also growing in use as a binder for non-woven fabric and may develop as a treatment resin to impart better hand and feel to cotton textiles. In all these uses only a small amount of resin is necessary per unit,

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Exports of vinyl chloride resins totalled 11 million lb. and vinyl compounds totalled 4 million for the first six months of 1953. There is some doubt that this market will continue much longer because vinyl resin plants are now producing or about ready for production in Japan, Mexico, Brazil, Great Britain, Yugoslavia, Italy, Germany, and other countries. In fact, there was even some importation of vinyl resin into the United States in 1953.

Capacity

There are now or soon will be ten firms engaged in production of vinyl chloride resin in this country. Several others are still flirting with the idea of entering the field. Capacity will probably be well over 600 million lb. annually by mid-1955, which, as the reader can see from Table E, is far above consumption. If the industry were suddenly asked to produce at that capacity, there probably wouldn't be enough raw material to supply it, for the whole national economy would then be operating at such a rate that demands for such things as chlorine for other uses would also be increased.

At present the industry is in good shape despite the decline in film and sheeting and perhaps a leveling off in such fields as wire coating. The over-all increase in volume in 1953, when some of the best vinyl markets were on the decline, is a testimonial to vinyl chloride's over-all usefulness.

Scarcely a year goes by that vinyl doesn't expand at a tremendous rate in some new direction. Several possibilities for the future have been pointed out in this article. And there are others. For example, there is vinyl coating over glass yarn for screen cloth and auto seat covers. There is also vinyl foam which looks like a possibility for rug backs, certain undisclosed automotive applications, refrigerator parts, and other developments now under cover.

In the automotive industry alone it is believed that vinyl chloride may average from 14 to 15 lb. per car in 1954 compared to 4 or 5 lb. just three or four years ago. That could mean 60 or 70 million lb. of vinyl resin for autos in 1953. The applications include upholstery, grommets, gaskets, welting, and even seat cushions. An estimated 100 lb. of rubber is used in an automobile, exclusive of tires, and nearly all of it—except radiator hose, engine supports, and spring cushions—are wide open for vinyl.

Such replacement of rubber by vinyl has been proved advantageous in many fields. As predicted in Modern Plastics in 1947, vinyl has made great inroads into a number of markets formerly dominated by rubber. Garden hose, wire coating, coated fabric, and floor coverings are among the applications where vinyl has taken over a great portion of the rubber market. But rubber, in turn, has found other new markets.

The tremendous production capacity build-up in both vinyl and rubber is a bit "scary" to the timid entrepreneur and indeed may require careful industrial tight-rope walking in the next few years. But if past history foreshadows the future, vinyl will continue to find new and expanding markets over the long pull.

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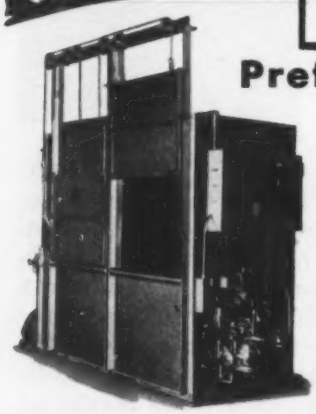

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Polystyrene

(*Continued from p. 79*)

The polyester business is believed to have consumed 26 million lb. of resin in 1953; 17 or 18 million in 1952; and about 12 million in 1951.

Ion exchange resins are in the styrene group. They are growing in use for water softening, removing salt from brackish water, and many other purposes. The volume is thought to be over 15 million lb. with great prospects for the future.

There are now or soon will be at least three new styrene resin producers in the field to add to the five older suppliers. One of the newcomers will make only the soft-type resins; another is going to engage in polymerization only, for the time being at least.

Of importance to the styrene industry is the vinyl toluene plant which came into production with experimental sales quantities in 1953. Full-scale production is scheduled soon. Here toluene instead of benzene is used to make monomers. The resultant product is said to be interchangeable with styrene from benzene for synthetic rubber, styrene latices, and most other styrene products. The product has a higher heat resistance and flash point than normal styrene, but would reportedly be more brittle as a molding powder; that property can be improved. Toluene is about 10¢ a lb. less costly than benzene and could be more plentiful if the petroleum companies want to make it so.

Another chemical company is expected to build a plant for production of alpha methyl styrene soon. This material is made from toluene and is almost an identical product to vinyl toluene. Still another company is expected to make alpha styrene on a small scale before long but has made no official announcement as yet.

Styrene and Rubber

Styrene monomer producers seemed a bit fidgety last year over what may happen to the Government's rubber plants. All but one of the styrene plants are privately owned, but the publicly-owned rubber plants are their biggest customers. Over-all styrene capacity must be in excess of 900 million lb. a year. A 680,000 long ton rubber operation rate would require about 340 million lb. of styrene monomer. But the rubber rate reportedly dropped to 500,000 long tons in the last quarter of 1953, at which rate styrene would be required at only 250 million lb. a year. There is no certainty of what the rate will be in 1954. With the cost of natural rubber now under the cost of synthetic and with a national foreign policy which would aid the southeastern Asian countries as much as possible by purchasing their goods, it is difficult to foresee what will happen. Furthermore, when the Government tries to sell the rubber plants, it will be handicapped by a law that prevents the sale if any one of the interested bidders objects to the terms of sale. The whole subject looks like the beginning of a mess that could create unusual conditions in the styrene industry and reflect back on plastics in various ways, including costs and raw material supply.

Styrene producers may therefore have plenty of troubles in the next few years, but the long pull looks extremely good. Plastics may not soon require as much monomer as the industry hoped, but it is a good bet for steady growth. Even if molding powder sales should level off—and that is unlikely in the near future—other types of resins have good prospects. And even if synthetic rubber production should be curtailed temporarily, that situation can't last for long. In the first place, many rubber trees have been tapped to death and not replaced; their owners fear the competition from synthetic rubber. But even if the rubber trees are replaced and such countries as Indonesia get back into big production, the market for rubber is rapidly increasing and more synthetic rubber will be needed. Tires, for example, have been increasing at a rate of 7% a year, even though gasoline sales for autos have gone up only 4 percent. And the increasing use of rubber for highways, in foam, and in conveyor belts, seems to go on and on. There is always the possibility, of course, that some rubber-like butyl which doesn't require styrene will usurp a large portion of the business. But chances are better than even that styrene is with us to stay for a long, long time and it would be no surprise if even greater quantities are needed by 1960.

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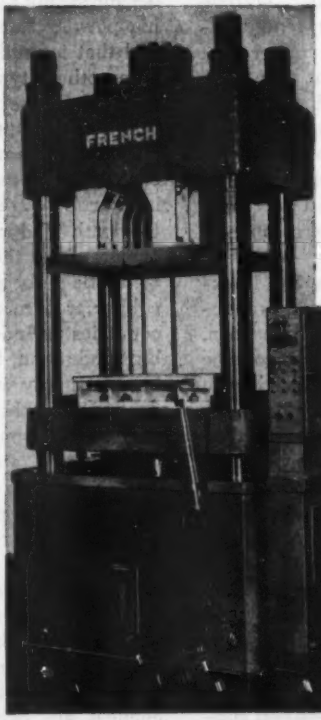

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Polyethylene

(*Continued from p. 80*)

Ten pounds of polyethylene make about 1000 bags for this purpose. If all carrots were packed in polyethylene, the potential would be about 13 million lb. of resin. If only half of them go to market in polyethylene, it would still be big volume. The big advantage is that carrots can be shipped without tops when encased in film bags. The saving is tremendous, something like 55¢ per crate in freight alone. It increases shelf life of carrots up to 10 days. A housewife can keep carrots in bags indefinitely under refrigeration.

It is believed that other root crops, such as radishes, onions, and potatoes, as well as citrus fruits and apples, will go to market in increasing quantities in polyethylene bags within the next few years.

Another beauty is banana packaging in polyethylene. In 1953 some six million stalks were shrouded with 1½-mil film tubes 26 to 28 in. in diameter and 48 to 56 in. long. The shroud saves importers 44¢ per stalk at a cost of 15¢ for material and labor. From 1948 to 1951, the average shipment of banana stalks was 98 million. The potential for polyethylene in this market is listed at almost 10 million lb. a year.

In one New England city, retail supermarkets used 50,000 polyethylene bags for vegetables every two weeks for a total of 126 lb. of polyethylene per store per week. There are 16,000 supermarkets of comparative size in the United States. At the same rate of use, 25% of these markets could use 10 million lb. of polyethylene every 20 weeks.

A close kin to film is polyethylene-coated paper, cellophane, and foil. About 15 million lb., including the low molecular weight material used in bread wraps, went for that purpose in 1953. Multiwall bags are particularly susceptible to a bigger invasion from polyethylene, especially as the material becomes lower in cost and gets closer to price competition with asphalt. There were over 1½ billion lb. of material used in multiwall, duplex, and single wall bags in 1951. It has been estimated that if just enough to supply the chemical industry with shipping sacks had been coated with polyethylene, 40 million lb. would have been required. In 10 years the

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same use might grow to require 53 million pounds. A portion of the wax paper market could possibly use 6 million lb. a year and special food boards might take as much as 18 million pounds. Butcher wrap paper, glassine, and can and drum liners could all use great quantities of polyethylene-coated paper; and the potentialities of polyethylene-coated cellophane are considered to be just beginning—it may be a specialty field but of considerable volume even so.

Bottles

There were thought to be something like 200 million polyethylene bottles produced in 1953. The total production of glass bottles was about 120 million gross. If the polyethylene penetration should go to 10% by 1960 as expected, the 10 to 12 million gross bottles resulting therefrom would require 57 to 60 million lb. of resin.

The glass people are not accepting the challenge from polyethylene squeeze bottles lying down. A new type of glass spray bottle, shaped to fit the hand and equipped with a molded urea atomizer plus a polyethylene tube, has hit the market with good effect. This should serve as a warning that polyethylene's competitors are *not* going to quit cold.

The technique of handling polyethylene and the marketing of finished products are not projects that will take care of themselves simply because polyethylene becomes more available. Printing problems, handling the film on present packaging machines, low melting point, oil absorption, and competition from even less costly materials (such as glass for bottles and paper for packaging) are not problems that can be laughed off without careful planning. The usual caution is to see that polyethylene is not used where it won't work.

Polyethylene pipe is a good example. About 20 million lb. of virgin material and from 3 to 5 million lb. of scrap were used for this purpose in 1953. The market is expected to double in 1955. Some people think it could even consume 150 million lb. by 1960. But troubles have already started bedeviling the industry. Polyethylene pipe bursts if too much pressure is applied; use of too much scrap weakens the walls; oil penetrates it; constant sunlight weakens its resistance to bursting. No one knows exactly what would happen if it were exposed to fertilizer around

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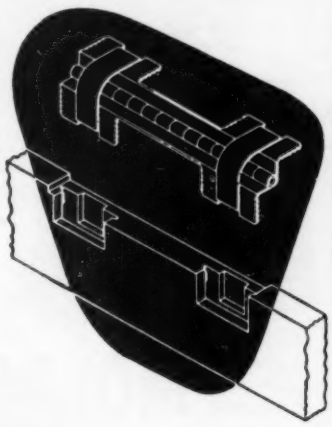

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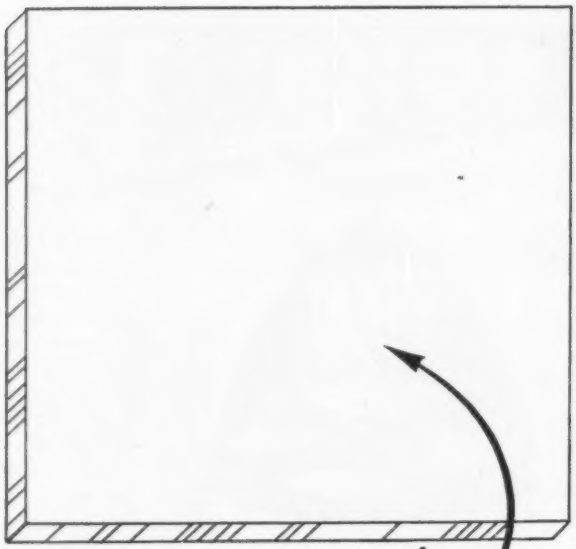

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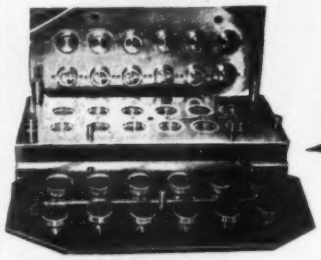

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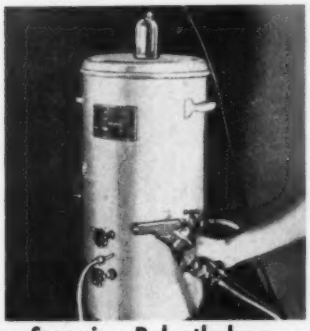

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a farmer's water line or grease in a drain or sewage pipe. Yet polyethylene pipe is a fine product if properly used and has vast potential for jet wells and certain types of irrigation, mine pipes, skating rinks, refrigeration systems, and other purposes. The great problem is to prevent the building up of prejudices by making certain that it is used only where it will perform without failure.

Injection Moldings

Injection molded polyethylene may one day consume almost as much material as film. There has not been enough of it for molders to really get going on large-scale production. Success of molded refrigerator dishes and battery parts has been proved. Housewares shows last year contained many exhibits of polyethylene canisters, pitchers, bowls, pails, and many other products. Toy manufacturers have already put it on the market for those less-than-a-dollar items that sell in vast quantities. Unbreakable polyethylene toys will no doubt be flooding the market in a year's time. Almost every day someone comes up with a new polyethylene molded item. How far this can go in the future is a question that only ingenious molders can decide when new markets are explored.

Electrical Applications

Wire coating and electrical uses may be a little slower in developing than those uses already named. It would be surprising if volume use should go much over 50 or 60 million lb. for several years to come. In the first place, the Armed Forces have been using so much that it will take time for the civilian economy to use up the amount taken by the military when that demand has subsided. Electrical uses also require long years of testing before they can be adopted. One promising possibility is polyethylene's use to replace paper as a wrap for certain types of insulation. Another is foamed polyethylene now being tried out for wire coating.

Each year this review chapter on polyethylene ends by stating that the list of possibilities goes on and on. It is hoped that the same ending will be possible for years to come. At the present time it is not likely that there is a man alive who would dare to predict when polyethylene sales would begin to level off for any protracted period of time.

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Applications

(*Continued from p. 86*)

vorite subject of discussion for many years — but usually not much more than talk. This year, the plastics industry has done something about it!

One of the first new furniture applications to appear in 1953 was a set of attractive molded phenolic drawers that are light in weight and resistant to moisture, chemicals, and heat. They are molded with no seams or cracks, and will not swell or stick in use (56). Also at the beginning of the year, a complete dinette set molded of plastics was exhibited at the Furniture Mart (57).

In the realm of the more fabulous, although it has aroused the attention of leading furniture manufacturers, is a comfortable arm chair with back and arm sections produced by spraying vinyl onto an open metal frame to form webbing and then sheeting (58). The seat of the chair consists of a pad of vinyl foam fitted into a section of sheet metal and then covered with vinyl sheeting by the spray method.

Also of interest as the initial step in opening up a new market are molded reinforced plastics bathtubs (59). At the present time, house trailers are the primary market for this application; indications are that housing developments will be next.

For decorating the interior of the home, a new series of vinyl laminates was made available to interior decorators, upholsterers, architects, and designers in 1953 (60). By locking fabrics, grass, or feathers between two sheets of transparent vinyl, a wide range of original design effects was achieved with the laminates. The laminates are available either as rigid or flexible sheet, permitting patterns in rigid laminates to be matched with flexible laminates.

Vinyl laminates using the same principle of design were also used for the shades of permanent lighting fixtures (61).

An unusual job — again accomplished with the spray-on technique used for the arm chair described above — was a completely seamless lampshade made by spraying cellulose acetate onto an aluminum form (58).

The combination of spray gun and spray-on plastics materials also played a part in creating an entirely new concept of architectural design and construction. As envisioned by a leading industrial designer, a complete beach house or summer home could be built by spraying vinyl onto a steel and wire frame (58).

Plastics glazing and structural sheets — both reinforced plastics and acrylic — increased in use in 1953 (62). Attractive in appearance and possessing outstanding physical properties, the panels can be used as sidewalls, windows, terrace shades, patio roofs, garage doors, etc.

Apparel and Accessories

The principal development in personal accessories in 1953 was a line of luggage molded of reinforced plastics — another pioneer in a new market (63). Incorporating a completely new and different type of design, the plastics luggage is tougher, lighter, and more economical.

An attractive thread made by spirally spinning polyethylene monofilaments around a rayon or cotton core was responsible for another unusual departure in the accessory field. The thread is woven into fashionable handbags, costume jewelry, and other trinkets that closely resemble strung beads (64).

In apparel, the search for new, improved materials resulted in the development of a vinyl film made porous to air but not to water (65). This "breathing" film has as many as 64 holes per sq. in. produced mechanically and at high speeds. Because of these perforations, the film is especially suited for application in the rainwear field. Men's and women's raincoats, fabricated of "porolated" film, are not only water resistant but, because the film can "breathe" through the tiny holes, keep the wearer cool even in hot weather. The film is also being used for baby pants, mattress and pillow covers, and furniture covers.

Signs and Displays

Acrylic, as in past years, captured the larger share of the sign and display market . . . and acrylic signs in 1953 grew bigger and bigger. One corrugated acrylic sign, over 130 ft. high and weighing 18 tons, was erected on a building in Texas (66).

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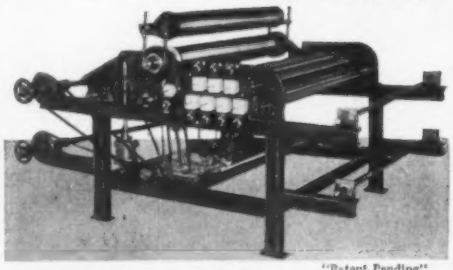

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in 1953 were the advances being made in the techniques of vacuum forming. Faster cycles, automatic equipment, and improved methods of decoration made it possible to more economically produce rugged and eye-appealing signs and displays of all types (67).

Reinforced plastics moved into prominence in the sign and display field in 1953. Corrugated reinforced plastics glazing and structural panels proved suitable for use in the construction of large colorful outdoor signs (62). In another type of outdoor display, a 6-ft. high reinforced plastic model of a famous trade mark was used to attract attention (68). And in a "soup kitchen" display unit for handily storing 60 cans of soup, a reinforced plastic front was combined with an acrylic face (69).

Other developments in plastics signs and displays in 1953 included a vinyl sheet printed on both sides to produce a three-dimension illusion (70) and an inflatable torso of vinyl sheeting to display bathing and foundation garments (71).

"Do-it-Yourself" Market

During 1953, the big "do-it-yourself" market mushroomed into upwards of a $3 million dollars a year business and the trend showed no signs of stopping. To accommodate the eager home handyman, the easy-to-work-with properties of plastics fitted neatly into the picture.

One of the principal materials to make a bid for a share of this market were reinforced plastics. In 1953, two "do-it-yourself" applications involving this material became very popular. The first of these were the reinforced plastics corrugated and flat structural panels which could be installed by the Saturday home mechanic easily and economically as porch or patio roofs or room dividers (62). The second was a packaged kit for home-application of reinforced plastics coverings to boat hulls (72). The kit, which consists of glass mat or cloth, a can of resin, and a can of catalyst, can be used to repair leaky boats, resurface wooden boat hulls, or maintain reinforced plastics boat hulls.

Still another product designed for self-application, this time by the housewife, were vinyl-coated tapes (73) to be used to join separate pieces of vinyl film neatly and permanently. With such tape, the house-

wife can buy vinyl film by the yard and make her own shower curtains.

Decorative plastics laminates, which have already proved themselves in the furniture field, developed into an important "do-it-yourself" material in 1953. This was primarily due to the development of new pressure-sensitive adhesives which make the installation of a laminate surface an easy, neat job that can be accomplished at home without special tools. All that the home handyman has to do is spread adhesive on the surface to be covered, spread adhesive on the bottom surface of the laminate, put the two together — and, as easily as that, he has his own laminated surface.

Self-applied plastics wall tile and coverings were also big factors in the "do-it-yourself" trend. Among the many introduced were a specially engineered decorative laminate panel that is held in place on the wall with metal molding strips (74) and a semi-flexible vinyl-surfaced 8-in. square wall tile designed for application to an adhesive-covered surface (75). One manufacturer was so convinced of the importance of the self-applied plastic wall tile market that he introduced a "do-it-yourself" kit, complete with coping saw and notched trowel (76).

The Future

The applications which have been described in this brief review are of more than common interest. Representing as they do the result of aggressive and imaginative thinking on the part of the plastics industry, these applications typify the year's new and important trends in plastics — trends toward quality, more effective and economical production processes, and an all-around sounder use of plastics.

To tomorrow's archivists, 1953 may well represent a milestone in the plastics industry. The transition from the concept of plastics as a replacement for other materials in conventional applications to that of plastics as a basic material to be used in original design for new applications has had a good start. From here on, it will be up to a forward-thinking plastics industry to take advantage of its opportunities.

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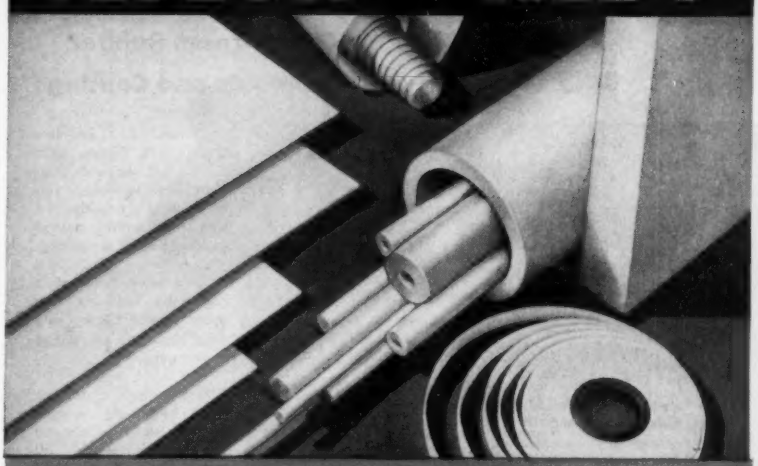

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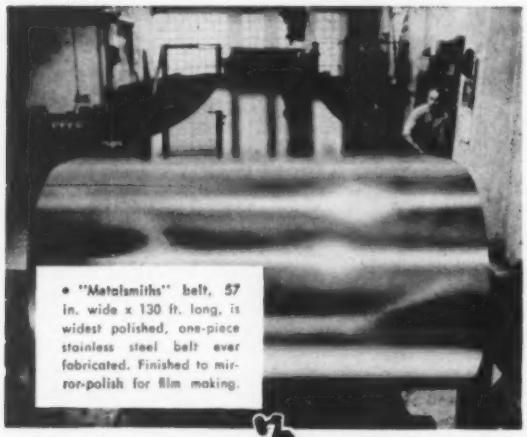

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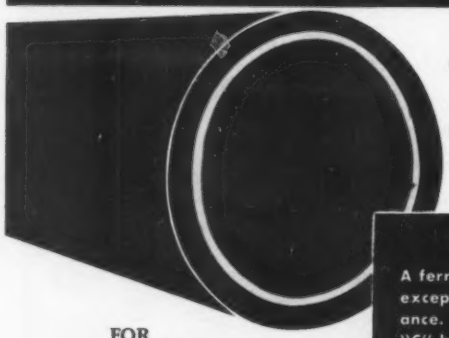

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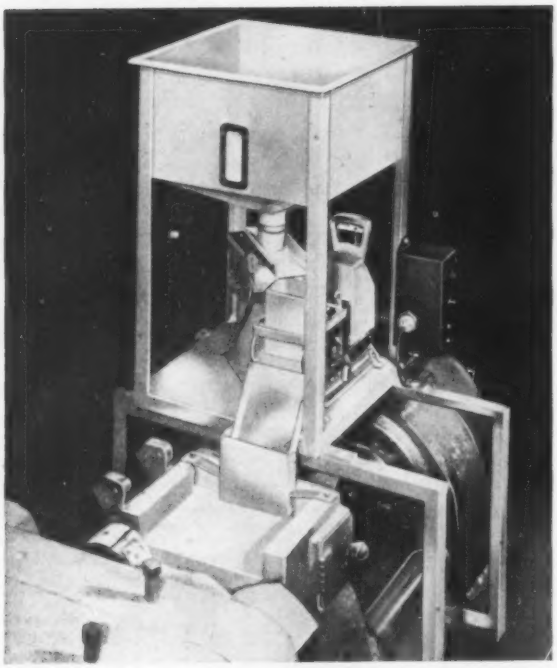

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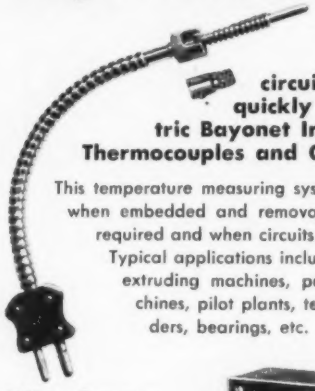

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Good News!

LARGER SIZES Polyethylene Sheets

Compression molded thermoplastic sheet users now have available larger sizes of Acadia polyethylene. These are available in the new size of 36" x 36" x 1/16".

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MANUFACTURERS AND CUTTERS OF WOOL FELTS

Developments: '53

(*Continued from p. 89*)

try, Monsanto has announced new capacity and several new varieties. While the cost of the isocyanates is still high, there is every indication that even by conventional synthesis these materials will at least come below a dollar a pound. Of course, the compounds including the alkyds are much cheaper.

The foams have already been referred to; but the epoxy foams, the phenolic foams, the vinyl foams, the polyester foams, and the isocynante foams are all offering good prospect of heat-resistant, insulating, bonding spacers between high tensile strength skins to give strong, lightweight structures. Of course, the manifold applications of the very light and useful Styrofoam of Dow, and the cellular cellulose acetate of Strux Corp. are already familiar.

The struggle continues to extend the limits of heat resistance, and this is of particular importance in many military applications. Du Pont has recently announced improved grooved roll calender and sintering methods for the heavy coating of wire with Teflon and ram extrusion of this polymer, and it seems likely that modifications of this technique will permit many other shaped uses which hitherto have been somewhat difficult to form. Bakelite is bringing in a polymer plant for fluorovinyl chloride (CTFE) in addition to M. W. Kellogg Co.'s capacity.

General Electric has recently announced a new silicone rubber with a tear strength of 200 p.s.i. and tensile strength approaching 1000 p.s.i., both of which figures are splendid improvements over prior materials. Dow reports some progress in transparent silicone resins, and recent papers before the American Chemical Society indicate that still further heat resistance may be expected when benzene rings and silicon appear in the chain without oxygen. Transparent polyethyl acrylate rubbers cross-linked with special heat-resistant materials have been reported to be quite satisfactory at 350° F. and to stand at least limited exposures to 425° F. Meanwhile, new supplies of the acrylate monomer have been brought in by Rohm & Haas working directly from acetylene and carbon monoxide, with considerable improvement over the earlier reported Reppe process. Fluoroacrylates appear also to be heat resistant.

Remarks about heat resistant polymers naturally lead to the condensation polymers. Nylon is too well established to require further mention here. Oriented Mylar film, however, the stretched polymer of glycol terephthalate, is showing remarkable promise because of its strength, transparency, low water absorption, and heat resistance. It seems destined to take much of the photographic and movie film market. I view it as another member of a long line of condensation polymers involving such materials as polyamides, isocyanates, recently patented polypyrrolidone, and polydichloromethyl oxybutane. All of these will ultimately provide high temperature molding compounds. All in all, it appears to me that these polymers in which the chemical and rubber companies are active will furnish plenty of material of improved properties to give ample scope for the ingenuity, industry, and profit of fabricators. A word of warning should be added: try all the materials thoroughly in any projected use before marketing the product.

Acknowledgements

This brief summary has been compiled with the help of many eminent plastics engineers; particular acknowledgment should be made to John McE. Sanderson of American Cyanamid Co.; H. Foster Robertson and Don Masson of Bakelite Co.; Dr. R. H. Boundy, C. B. Branch, and A. E. Young of The Dow Chemical Co; W. A. Franta of E. I. du Pont de Nemours & Co., Inc.; F. J. Groten of Firestone Tire & Rubber Co.; J. W. Raynolds and Dr. L. S. Moody of General Electric Co.; John R. Hoover and C. D. Segner of B. F. Goodrich Chemical Co.; Herman Thies and R. S. Earhart of The Goodyear Tire & Rubber Co. Inc.; Frank Carman of Manufacturing Chemists' Association, Inc.; H. W. Mohrman and Dr. Robert J. Schatz of Monsanto Chemical Co.; James Bailey and C. Paul Fortner of Plax Corp.; Dr. D. S. Frederick of Rohm & Haas Co.; Dr. W. J Sparks of Standard Oil Development Co.; and my associates H. M. Richardson, Dr. M. H. Nickerson and Sven Richter.

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Engineering

(*Continued from p. 91*)

Molding" (March), the prize winning paper in the 1952 Annual Prize Paper Contest conducted by S.P.E., clearly explained the following fundamentals of injection molding and their relationship to high quality molded parts: 1) injection temperature, 2) injection pressure, 3) plunger forward time, 4) mold temperature, 5) mold closed time, 6) mold open time, 7) clamping force, and 8) plunger speed.

"Metallized Butyrate Reflectors" (March) revealed the engineering development work which overcame the difficulties of metallizing molded butyrate.

"Fully Automatic Injection Machine" (April) described a fully automatic air-operated injection machine recently placed on the market by Guy P. Harvey & Son Corp., Leominster, Mass.

"Pressure Gage for Injection Molding" (April) described the construction and operation of a gage which makes possible the exact measurement of the pressure in an injection mold.

"Experience Brings Improvements" (May) described five refinements which have been engineered into Stokes-Windsor Extruders.

A nomograph and two curves, along with a description of their use, explained "How to Calculate Expansion of Acrylic Sheet" (June).

"Heating with Far Infra-red" (Aug.) detailed the difference between infra-red and far infra-red radiation and described the use of the latter in fusing plastisols and organosols as well as its uses with embossing and vacuum forming equipment.

"Mold Temperature Control," (Oct.) pointed out the reasons for accurate controlling of mold temperatures as well as the fundamental requirements for a good temperature control unit.

"Embedding in Acrylics" (Nov.) gave complete details on the process from preparation of materials to be embedded through the final machining and finishing of the casting.

"Molding Swivel Chair Bases" (Dec.) described the production techniques and outlined the advantages of reinforced plastics swivel chair bases.

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GLAZING WITH "PLEXIGLAS." Booklet gives detailed data on glazing industrial and other buildings with flat panels of "Plexiglas" acrylic plastic. Details on economies, advantages, and mechanics of installation. Rohm & Haas Co. (A-402)

PANEL SAW FOR SIZING SHEET STOCK. Description of several models of a panel saw which may be used for sizing corrugated structural plastic panels, sheet plastics and other sheet materials. Hendrick Manufacturing Corporation. (A-403)

SPECIFYING CORRUGATED BOXES. Booklet enumerates the various details to be considered when establishing specifications for corrugated shipping containers for various products. Hinde & Dauch Paper Company. (A-404)

DRY BLENDING POLYVINYL CHLORIDE FOR EXTRUSION. Details on the techniques for efficient dry blending of "Opalon" p.v.c. resin for extrusion. Lists types of mixers, techniques for formulating, and manufacturers of extruders and coloring materials. Monsanto Chemical Co. (A-405)

VACUUM FORMING MACHINE. Folder describes the process of vacuum forming plastic sheet stock. Information and specifications on a fully automatic unit for producing a wide range of products by this process. Vacuum Forming Corporation. (A-406)

SPRAYED METAL MOLDS. Folder explains the advantages of metallized molds for low pressure, vacuum, and slush molding. Tells how to estimate roughly the cost of such molds. Metalmold Forming Company. (A-407)

FLUORINATED RESIN. Technical data on "Exon 40 XR-61," a non-flammable fluorinated resin which is inert to inorganic chemicals, heat, and light, yet is soluble in selected organic solvents. Can be spread, coated, dipped or brushed on plastics, textiles, etc., to make them resistant to various materials. Firestone Plastics Co. (A-408)

HEAT TREATING "KEL-F." Bulletin explains how specific thermal treatment can be used to vary the flexibility, the effect of organic solvents, the transparency and hardness, and to assure dimensional stability of molded "Kel-F." The M. W. Kellogg Co. (A-409)

"DUREZ PLASTICS NEWS." Latest issue of this house organ illustrates and describes a number of interesting products which are being molded with Durez phenolic resins. Durez Plastics & Chemicals, Inc. (A-410)

MOLD TEMPERATURE CONTROL. Folder on "Thermolator" controls for maintaining injection mold temperatures within limits of ½°F. Industrial Mfg. Co. (A-411)

"ELECTROLIMIT" INTERNAL COMPARATORS. Brochure explains the operation and applications for "Electrolimit" internal comparators which accurately and precisely measure internal diameters to maintain product quality control. Pratt & Whitney, Div. Niles-Bement-Pond Company. (A-412)

"BRACKETUBES" FOR STEAM HEATED PLATEN PRESSES. Data on how seamless flexible metal "Bracketubes" eliminate joint packing, reduce maintenance costs and prevent "down-time" when installed on steam heated platen presses. American Brass Co. (A-413)

"CALROD" ELECTRICAL HEATERS AND HEATING DEVICES. Catalog on "Calrod" electric heaters and heating devices describes an extremely wide range of items in terms of application, special features, installation, and pricing. General Electric. (A-414)

INJECTION MOLDING MACHINE. Specification sheet and price data on a 1¼-ounce high speed injection molding machine that can be operated manually or fully automatically. Moslo Machinery Co. (A-415)

"GEON" LATICES. Chart lists the properties and typical applications for nine "Geon" latices which are water dispersions of polyvinyl chloride base resins. B. F. Goodrich Chemical Company. (A-416)

PLASTICS WELDING SCHOOL. Information about, and curriculum of, the Agile Plastic Welding School which teaches the techniques of hot gas welding of polyethylene and unplasticized polyvinyl chloride. American Agile Corporation. (A-417)

UNROLLS AND REROLLS. Paper discusses the construction and advantages of various types of unrolls, tensioning devices, and rerolls for web materials. Frank W. Egan & Co. (A-418)

FORMICA FOR BEARING SURFACE APPLICATIONS. The use of Formica End Grain Grade C for bearing surface applications in the manufacture of heavy machine tools is explained in a bulletin issued by The Formica Co. (A-419)

UNIVERSAL TESTING MACHINE. Data on the Baldwin-Emery SR-4 universal testing machine of 50,000 lbs. capacity for testing specimens or parts in tension, compression, flexure, torsion, alternating load, creep, stress relaxation and shock. Baldwin-Lima-Hamilton Corporation. (A-420)

MARKING TOOLS. Booklet describes the various steel marking dies, number and letter sets, trademark stamps, and press marking dies available from The Parker Stamp Works, Inc. (A-421)

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COLORING AND CUSTOM COMPOUNDING OF PLASTICS. Brochure describes the production facilities of Westchester Plastics, which are devoted mainly to coloring and custom compounding of thermoplastic materials. Westchester Plastics, Inc. (A-424)

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VACUUM DEEP DRAWING AND FORMING MACHINE. Bulletin on "Formvac" twin head automatic deep drawing and forming machine for converting rigid and soft thermoplastic sheets. Describes the principles of operation, specifications and typical products. Hydro-Chemie, Ltd. (A-427)

RESIN COATINGS FOR THE CHEMICAL INDUSTRIES. Information on how "Bakelite" and "Vinylite" resin coatings are used to reduce maintenance costs in the chemical industry where corrosive, abrasive and other difficult products must be handled. Bakelite Co., Div. of Union Carbide and Carbon Corp. (A-428)

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INDUSTRIAL CHEMICALS. Catalog enumerates and describes the various plasticizers, plastics resins, solvents, and other industrial chemicals manufactured and sold by Tennessee-Eastman Co., Div. of Eastman Kodak Co. (A-435)

NYLON BALLS. Price list shows new lower prices for precision fabricated FM #10001 Dupont nylon balls for use in valves, anti-friction bearings, mechanical checks, and other industrial applications. Ace Plastic Co. (A-436)

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AUTOMATIC COMPRESSION MOLDING MACHINES. Bulletin on Baker fully automatic compression molding machines for high speed molding of small and medium size parts from phenolic, alkyd, urea, "Teflon," and other plastic materials. Baker Brothers, Inc. (A-443)

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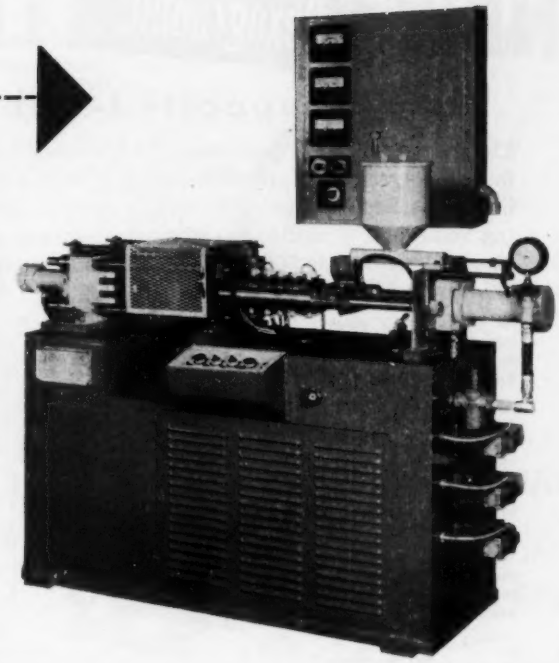

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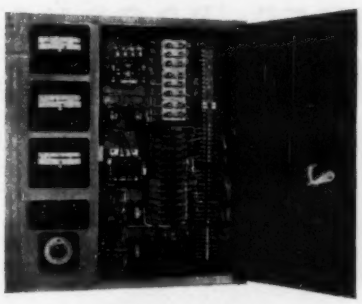

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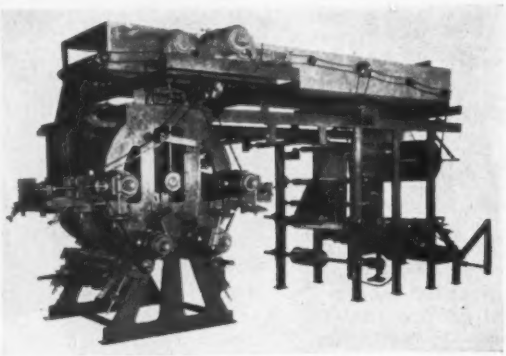

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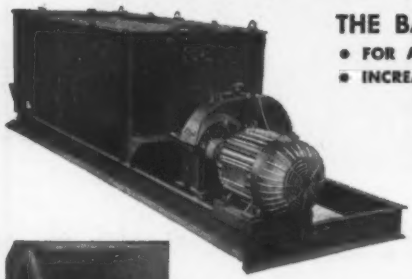

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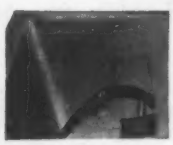

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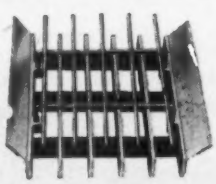

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Preplasticizer

(*Continued from p. 96*)

proved for molding in that the spreader in the heating chamber is internally heated, directing heat to both sides of the plastic flow section. Plasticizing is rated at 400 lb. of polystyrene per hour although in actual operation the machine has been successful in plasticizing 600 lb. per hour.

Another important item of the feed mechanism involves the separate and independent hydraulic power unit employed to reciprocate the feed plunger. This dual gear pump system permits plasticizing to be a continuous operation as the feed plunger is operated by a separate source of power.

In conjunction with the independent feed unit, this machine feeds the plasticized material directly from the heating chamber into a prefill or storage sleeve. This prefill chamber holds slightly more than 200 oz. and is mounted 90° from the injection sleeve and nozzle extension serving the mold. From this chamber, the injection sleeve is filled with its complete charge of plasticized material with one stroke of the prefill plunger, thus permitting an entire 200 oz. of material to be fed into the shooting sleeve in a matter of 2 or 3 sec., if desired.

The prefill chamber permits the plasticizing process to go on at all times with the exception of the 2 to 3 sec. required to transfer the material from the prefill chamber 2 or 3 sec., if desired.

This machine will displace material into the mold at a maximum speed of 7000 cu. in. per minute. To accomplish this high-speed injection requires a connected horsepower for injection alone of 250 horsepower. Two large H-P-M variable-delivery high-pressure radial pumps (each of 110-gal. per min. capacity) generate the hydraulic pressure for injection. These same pumps traverse the clamp ram during mold opening and closing. A 30-gal. per min. H-P-M high-pressure variable-delivery pump provides the necessary mold clamp slow-downs prior to mold contact, mold breakaway, and just prior to bumper bar ejection. This same pump generates the live hydraulic pressure used to clamp the mold during injection.

Injection Speed

(*Continued from p. 101*)

cylinder and thus eliminating this source of excess pressure drop. It was found that injection speed was so critical that when certain parts were running satisfactorily, any variable that was changed which increased the fill time by as little as 5% resulted in a scrap piece.

Sink Marks

After a mold has been running on a satisfactory cycle and the speed of injection is decreased by reducing the pump volume output, the first defects to be noted are sink marks at the perimeter of the piece. A further decrease results in a thickness reduction and an unfilled piece. In some cases, where slow speed of injection is used, a peculiar flow phenomenon can be observed. The hot material chills and becomes more viscous, and flow momentarily slows down or stops. Then, as the pressure builds up, the mold opens slightly. This opening permits the incoming hotter plastic to "break out" and flow past the colder material. This broken or interrupted flow produces several well-defined defects:

1) A ragged plastic flow, which produces many poor weld lines and sometimes trapped air marks. (Flow patterns are very markedly changed when the speed of injection is reduced.)

2) The appearance of very large depressed areas resembling huge sink marks on the part. These depressed areas represent the thickness of the part before the clamp ram is backed off and the hotter plastic "breaks out."

These two defects are illustrated in Fig. 1. The panel shows the large depressed areas and a rather uneven flow of plastic resulting from the reduced injection speed. Time for injection of this shot was 17.5 seconds. Four gates were used in this mold to obtain sufficient injection speed to make a panel this large in the thickness required. These gates were each located at the intersection of three ribs. This panel measures 1500 sq. in. in area and averages 0.085 in. thick. The panel in Fig. 2 was made at full injection speed, 4.5 seconds. The part was completely filled out. However, previous experimental short shots had been made in which the part did not completely fill out. The areas of these short shots are illustrated by the lines drawn on the part. The lines illustrate four short shots, each successively closer to being filled out completely. The numerals shown for each of these short shots represent the total weight in pounds of each section of the shot.

Increased Strains

Reduced injection speed also produces increased strains, which can be readily observed in clear parts. These strains are due to increased frozen orientation because the plastic flows for a longer time while it is being cooled. The part in Fig. 3, as observed through crossed Polaroids, is less strained than the part in Fig. 4. The latter was made on the same cycle used for the former except that only one-half the injection rate was used.

In order to further investigate the effects of injection speed, an extensive experimental program was undertaken to find the answers to a number of questions which had arisen in the course of the earlier work. These questions were:

1) What would be the effect on large-area moldings if higher rates of injection than those presently used could be obtained?

2) Would it be possible to determine an optimum rate of injection above which nothing is gained or detrimental effects begin to come into evidence?

3) What should be requested from manufacturers of new and larger presses, from the standpoint of injection rates and injection pressures as well as the other more easily determined specifications?

Results of this experimental program show that high rates of injection are a definite requirement for producing thin, large-area moldings. How high to go is still an unanswered question. No optimum rate was found in the above work. Neither was any detrimental effect noted in the molded pieces. However, the above beginning indicates that much more work is necessary to evaluate fully high rates of injection. Also, more data are needed so that intelligent specifications can be written for large machines.

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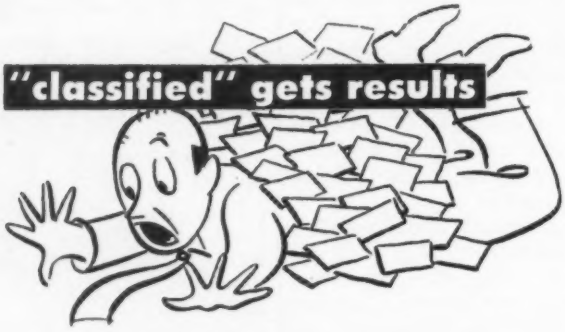

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Restricted Gating

(*Continued from p. 104*)

wide. Thickness varies from approximately 5/32 to 7/16 inch. Weight is 1¾ oz. in Vinylite elastomer of 1.36 specific gravity.

A four-cavity mold had been designed and built but the molder was not able to produce satisfactory pieces. A 90 durometer compound had been specified and QG-9590 Blue 139 (a standard Vinylite molding compound) was being used. Normal mold design practice had been followed and each cavity was supplied by a ¼ in. full round runner and a good-sized ⅛- by ¼-in. gate at one corner. The handles molded in this mold were low in gloss with numerous surface inperfections. Use of the highest possible cylinder temperatures without material decomposition gave unsatisfactory pieces.

A restricted gating system similar to the one successfully used in the color checker mold was recommended and its trial immediately gave beneficial results. The improvement in appearance was very striking and the molder since then has been molding this item successfully on a production basis.

Principles

Some general principles of restricted gating for Vinylite elastomers can be proposed based on the work described above. 1) The gate must be considered as not only the immediate entrance to the mold cavity, but to include the runner area near this entrance as well. 2) The runner to each cavity should be full round, normally ¼ in. in diameter, and interrupted by a restriction approximately ¾ in. from the entrance to the cavity. This restriction should be 1/16 in. long and 0.015 in. or less in diameter. The restriction should be centered in the runner. There should be no streamlining of the runner at the restriction. 3) A pin ⅛ in. in diameter should be placed in the runner between the restriction and the cavity. This pin should be 0.100 in. from the restriction. 4) The actual entrance into the cavity should be flush with the cavity on one side and stepped away 0.010 in. on the other side. This entrance should be at least ¼ in. wide for moderate sized pieces.

(MODERN PLASTICS, October 1953)

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(*Continued from p. 133*)

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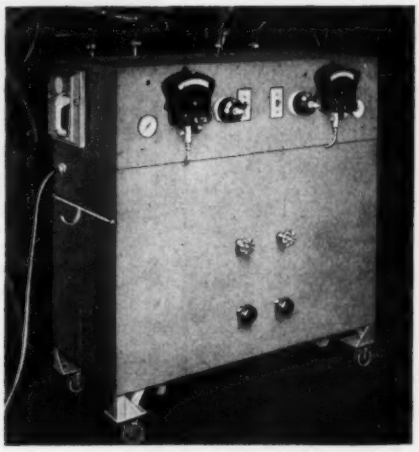

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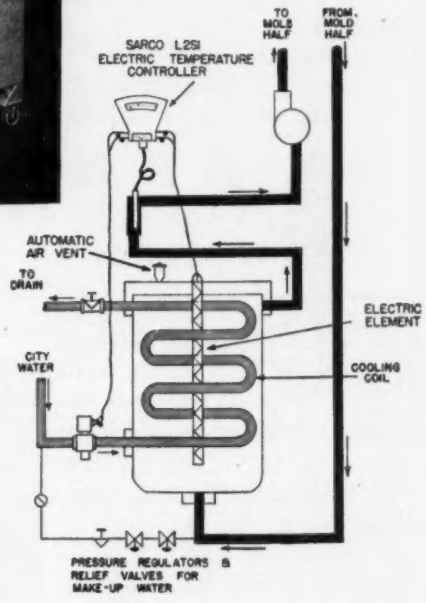

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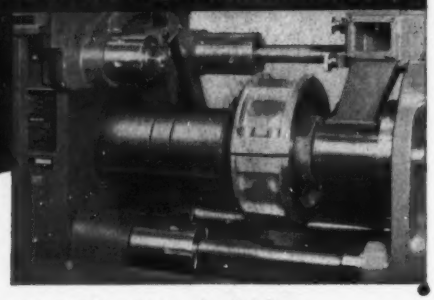

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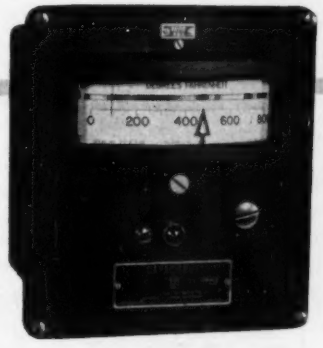

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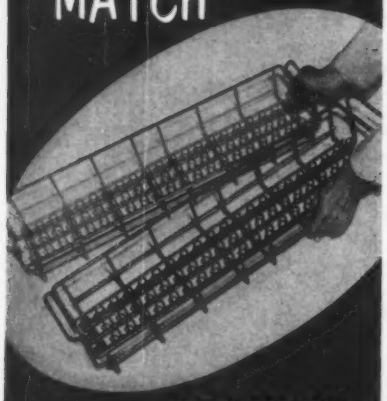

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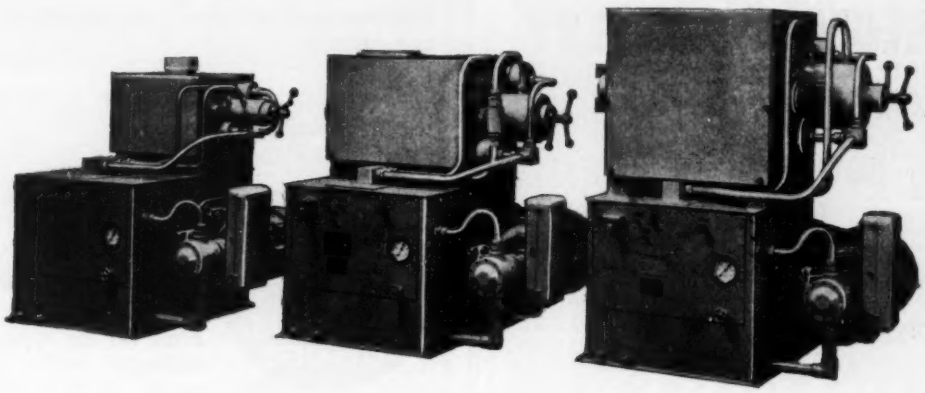

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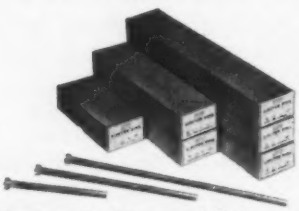

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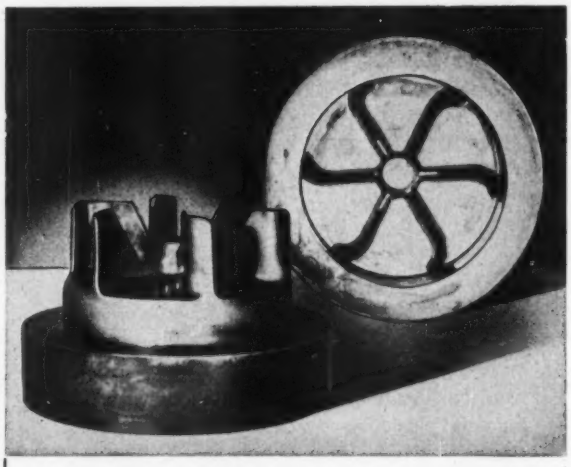

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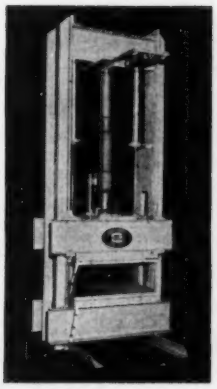

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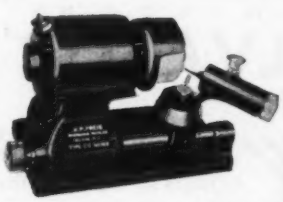

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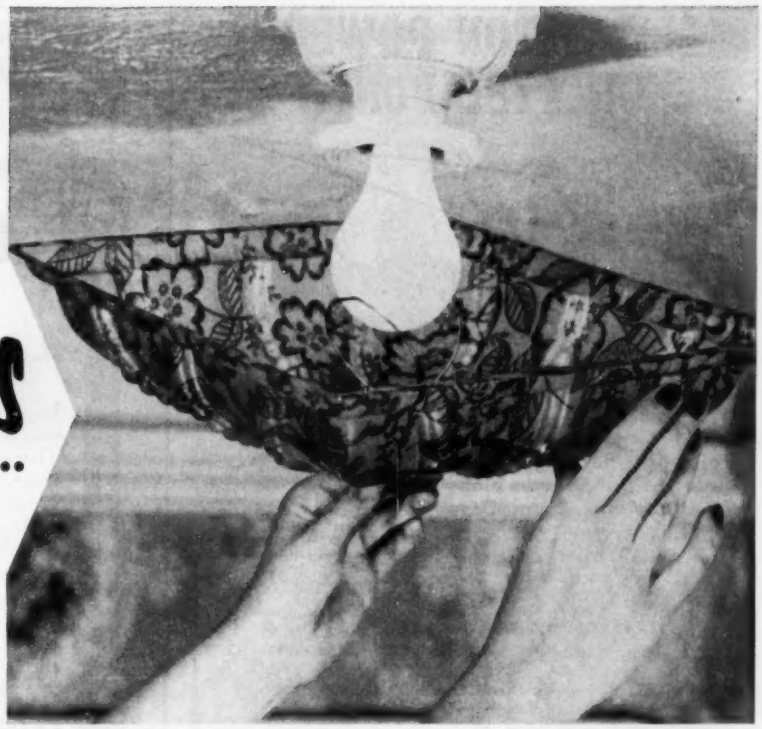

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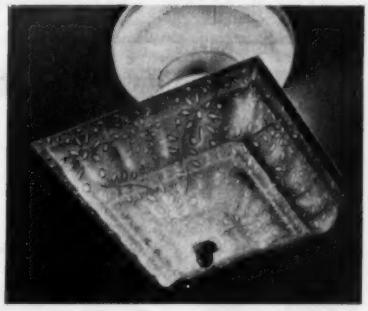

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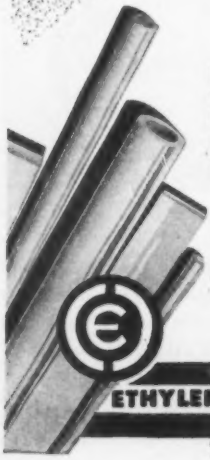

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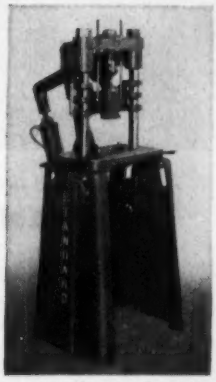

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Plastisols • Organosols • Latex • Slush Molding and Dipping of Plastisols and Latex • Custom Silk Screening and Heat-Sealing of Vinyl Film • Southern Reps. for Harte & Co., Mfgs. of "Wataseal" Film & Sheeting

Chart of Glazing and Structural Panels

List of additional suppliers, together with details on available sheet sizes, thicknesses, and weights

TO THE "Source Chart of Plastics Glazing and Structural Panels," which appeared in the November 1953 issue of MODERN PLASTICS in connection with the article "Boon to Builders" (pp. 87-92, 193, 196, 198-200, 203), should be added the following companies:

Imperial Chemical Industries Ltd., Plastics Div., Black Fan Rd., Welwyn Garden City, Hertfordshire, England—This company makes available through its distributors in the United States (J. B. Henriques, Inc., 521 Fifth Ave., New York 17, N. Y.), a wide range of "Perspex" flat and corrugated cast acrylic sheet.

Currently in stock in the United States and ready for immediate delivery are colorless transparent flat acrylic sheets in standard thicknesses from 0.4 to 1 inch. Standard sheet sizes for this stock are: 24 by 36 in.; 36 by 48 in.; 40 by 50 in.; 48 by 48 in.; 48 by 60 in.; 48 by 72 in.; and 60 by 72 inches. Approximate weight of the acrylic sheet ranges from 0.25 lb. per sq. ft. for the 0.040-in. sheet to 6.19 lb. per sq. ft. for the 1-in. sheet.

Colored sheet—incorporating a complete range of translucent and opaque colors—and corrugated acrylic sheet are normally not carried as Stateside stock, but must be ordered from abroad. Shipment to the customer is usually within six to eight weeks.

The corrugated sheet can be had in various conventional profiles for decorative and structural purposes. It is available in clear, translucent, and tinted colors, in lengths of 3 to 10 ft., and in widths of 26 and 32 inches. Standard thickness is ⅛-inch.

Special sizes and colors may also be ordered from abroad.

Russell Reinforced Plastics Corp., 521 W. Hoffman Ave., Lindenhurst, L. I., N. Y.—Reinforced plastics panels in flat sheet only are produced by this company under two different trade names—Repco Panels and, more recently, Gradation Tropiglas, a new type of sheet developed to provide various degrees of light transmission.

The reinforced plastics sheets are available in thicknesses of 1/16 in., 3/32 in., and ⅛ inch. Standard stock sizes for sheets are 4 by 8 ft. and 4 by 9 ft.; and approximate weights for the three stock thicknesses are 0.50 lb., 0.75 lb., and 1 lb. per sq. ft. of material.

Fibrous glass content for each of the stock thicknesses of reinforced plastics sheet are 2 oz. per sq. ft., 3 oz. per sq. ft., and 4 oz. per sq. foot.

The sheets are available in white, yellow, coral, blue, green, or honey wheat.

Plastic Glass Corp., 33 Ave. P, Newark, N. J.—This company supplies cast acrylic sheet in thicknesses from 0.060 to 2 inches. Standard sheet size is 36 by 48 in., but special sizes can be custom-made upon request. Approximate weight of the material ranges from 0.37 lb. per sq. ft. for the 0.060-in. sheet to 12.32 lb. per sq. ft. for the 2-in. sheet.

Standard opaque and transparent colors include, among others, red, amber, yellow, green, blue, and white. Clear transparent sheets are also available, as well as a wide selection of custom-made colors to fit individual requirements.

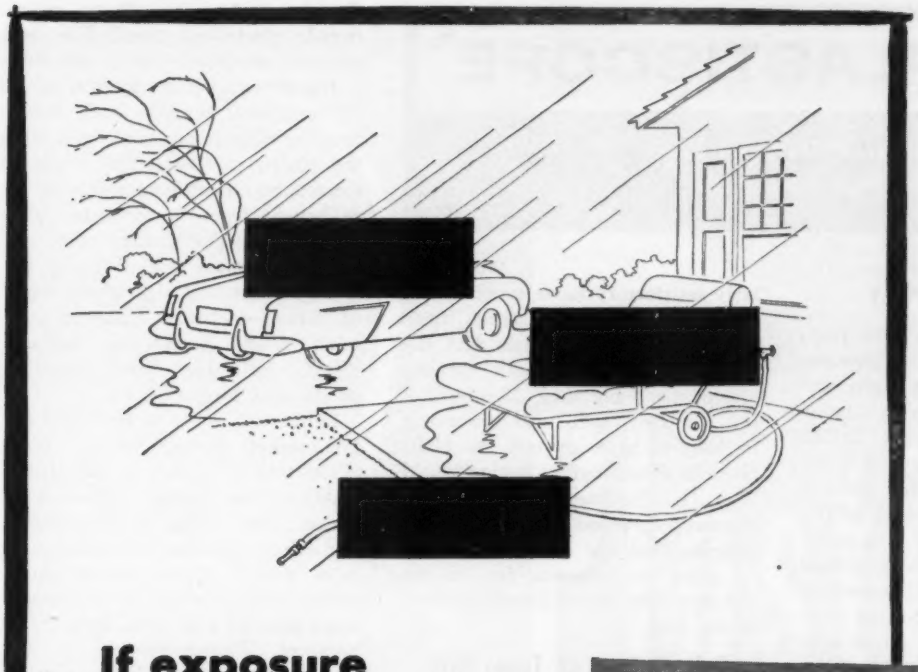
Strick Co., Whitaker Ave. at Godfrey, Philadelphia 24, Pa.—This company is currently producing flat and corrugated reinforced plastics sheet trade-named Daycor. Sheets are available in either of two finishes—smooth or crinkled.

Standard thickness is 0.060 in, with a fibrous glass content of 2 oz. per sq. foot.

Standard colors are blue, yellow, white, green, coral, clear, and daylight green. Forest green, red, and light blue are also available.

The three modules of corrugation in which the sheets are available are: 2½ by 5/8 in.; 2.67 by ⅞ in.; and 1¼ by ¼ inch.

Stock sheet sizes for flat panels are 2 ft. by 10 ft. and 3 ft. by 10 feet. Stock sizes for corrugated panels are 27½ in. by 6, 8, 10 or 12 ft.; 33½ in. by 6, 8, 10, or 12 ft.; and 37½ in. by 6, 8, 10 or 12 feet.



If exposure shortens the life of your vinyl products

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You can't do much about the weather.

But stabilize your vinyl products with "Dutch Boy" Dyphos, and you'll see that weather can't do much harm to them.

With Dyphos, you'll find that under outdoor exposure your opaque vinyls have excellent color retention and long-lasting flexibility. That's because Dyphos imparts unequaled light stability.

In processing, too, the use of "Dutch Boy" Dyphos works to your advantage because of its excellent heat stability.

So, whether you work with plastisols or organosols . . . whether your method is slush or conventional molding, extruding, calendering, or coating . . . use "Dutch Boy" Dyphos.

For more information on Dyphos (or any of the other "Dutch Boy" stabilizers) just write. We will be glad to supply factual data and technical assistance.

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
[redacted]	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Dutch Boy*

*Reg. U. S. Pat. Off. **CHEMICALS** *

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

New Phenolic Plant

CONSTRUCTION of a new plant for the manufacture of phenolic molding compounds has been announced by Durez Plastics & Chemicals, Inc., N. Tonawanda, N. Y. The new plant will be located on a recently acquired 70-acre site in Kenton, Ohio, 75 miles south of Toledo. Use of an entirely new process is planned which is described as completely mechanized and which it is assumed will reduce labor costs and perhaps result in lower cost operations. It is anticipated that the annual production of the new plant will exceed 64 million lb. of various types of phenolic compounds. That amount is equal to 30% of the total sales volume for phenolic molding material in 1953. The company anticipates that the plant will be completed in eight months.

The new compounding plant at Kenton is a part of the expansion program started sometime ago with the purchase of the 100-acre site at Kittanning, Pa. The plant to be erected at the latter location will be the major source of supply of phenol, formaldehyde, and other raw materials for the Kenton plant.

A new addition to the company's phenol plant at N. Tonawanda has also been recently added to the company's production facilities.

Another Phenolic Plant

A CERTIFICATE of Necessity has recently been granted to Plastics Engineering Co., Sheboygan, Wis., for the construction of plastics molding compound facilities. The amount of the certificate is $451,793 and 45% has been allowed for rapid amortization according to the usual Government procedure.

Within the last few years Plastics Engineering Co. has become an ever-increasing influence in the affairs of the phenolic industry. Their compound that was particularly satisfactory for television cabinets and other large pieces made a hit just about the time that the television industry was getting started in a big way. Members of the company were also prominent in helping to work out the M-52 phenolic fuse program during World War II. The new Certificate of Necessity granted to them would indicate that the company expects to make its presence felt in the industry even more forcefully than in the past.

* Reg. U. S. Pat. Off.

Polyethylene at Texas City

SELECTION of Texas City, Texas, as the site for Monsanto Chemical Co.'s first polyethylene production plant was recently announced. Located adjacent to Monsanto's present Texas City plant, the new polyethylene unit, operated by the Plastics Div., is expected to produce commercial quantities of polyethylene starting in the fourth quarter of 1954. Plans announced last March set initial capacity at about 66 million lb., with a 50% increased capacity scheduled for 1957.

Robert K. Mueller, general manager of the Plastics Div., states: "Texas City was chosen as the plant site after careful consideration of 16 other possible locations. Monsanto believes it has settled on the most logical location for initial operation." The Texas Div. produces styrene, vinyl chloride, and acrylonitrile at this location and will supply the Plastics Div. unit with its raw material, ethylene.

Advertising Vinyl

A BROAD program to integrate extensive national advertising of the trade-mark Krene with concentrated local merchandising of products made of Krene has been announced by Bakelite Co., a Div. of Union Carbide and Carbon Corp., 260 Madison Ave., New York 16, N. Y. The company designates the trade-mark as a symbol of superior, flexible plastics, identifying calendered, plasticized vinyl film and sheeting produced only by Bakelite.

The advertising campaign is aimed at consumer, retailer, and manufacturer alike to acquaint them with the quality of Krene. The company expects manufacturers and retailers to benefit from the program with the promotion of greater sales volume; consumers will profit by the quality upgrading of products made of Krene—rainwear, shower curtains, closet accessories, nursery items, inflatable toys, sporting goods, and luggage.

Key retail stores in 50 major retail markets throughout the United States will be invited to participate. Bakelite has engaged Pokrass & Gauss, Inc., retail merchandising and sales promotion counselors, who have trained three special representatives to contact the stores and work directly with retail store management. Representatives in the Eastern, Central, and Western zones who will present the Krene program to management executives and buyers in each area are, respectively, Philip Trent, Norman Goldblatt, and John Kovacs.

A special series of advertisements in trade and national magazines will initiate the merchandising campaign, which will focus consumer attention on a new tag and label to help establish buyer recognition for end products made of Krene.

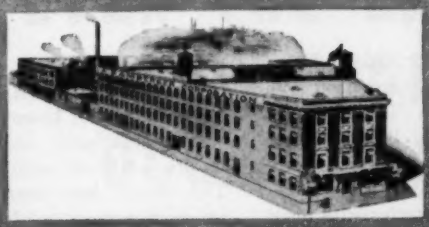
Special promotion kits for each type of product made of Krene will be supplied to buyers and sales and promotion personnel of stores to follow up the intensive national advertising at the local level. New merchandise hang tags and labels will incorporate the Krene trademark in an easy-to-recognize trefoil design.

In conjunction with the merchandising program, Bakelite will also release a new educational soundslide film that will be shown to sales personnel in each store contacted. The 15-min. film presents the program in broad outline and stresses the best methods for obtaining increased sales from it.

Arc-Resistant Thermoset

DEVELOPMENT of a new phenolic molding material with improved arc resistance and excellent dimensional stability has been announced by Monsanto Chemical

if you work with Plastics you should work with us . . .



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PLASTICS MATERIALS

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THE PLASTISCOPE

Co.'s Plastics Div., Springfield, Mass. The new material, Resinox 3700, was described by Clark L. Richards, sales manager of thermosetting molding materials, as a tailor-made product which combines the electrical and physical characteristics most often demanded by the molders and end users of arc-resistant parts.

Mr. Richards states: "Most important single advantage of Resinox 3700 is its high arc resistance which has been measured at 184 sec. in standard A.S.T.M. tests. It also boasts excellent dimensional stability, which means that the problem of after-shrinkage, a serious objection to most of the arc-resistant materials now in common use, virtually has been eliminated."

Mr. Richards also points out that the new material has excellent moldability, including good transfer molding properties and relatively good impact strength and heat resistance.

Mineral-filled, Resinox 3700 is recommended for use in distributor caps, motor control circuits, power transmission circuits, electrical connectors, ignition parts, switch panels, and radio tube bases.

Monsanto also announces the development of several other materials: A new low-cost extender type of plasticizer for vinyls, called HB-20. The new material, a partially hydrogenated alkyl-aryl hydrocarbon, is a water white, high boiling, and practically odorless liquid which also shows promise for use as a plasticizer for polystyrenes, ethyl cellulose, and asphaltic compositions.

Added to the company's styrene family is a styrene latex system, a comparative newcomer to the exterior masonry paint field.

For the plywood and furniture industries, Monsanto has developed two new liquid urea resin adhesives with high solid contents. The products, called Lauxite UF-101A and Lauxite UF-112, contain 60% solids and 65% solids, respectively. Thomas J. Martin, sales manager of coating resins and adhesives, states that the most important advantage of the adhesives is their high rate of reactivity, particularly in hot press operations. "In such applications," he says, "cycles have been obtained which are faster than those ever before achieved with a urea resin. The result has been an average production increase of approximately 25 percent."

Polyethylene Prices

ANNOUNCEMENT of a 3¢ per lb. reduction in the most widely used grades of its new Alathon polyethylene resin has been made by Du Pont. The cut brings the price of natural Alathon resins for molding and extrusion to 46¢ per pound.

Du Pont also announces that a new version of Alathon, introduced last September as a development of a continuing research program for product improvement, is now being made commercially in the company's plant near Orange, Texas.

Course in Corrosion

A FIVE-DAY course which will present a brief but intensive review of the fundamental aspects of corrosion, followed by panel discussions and lectures on the applications of corrosion control in industry, will be held on the campus of Washington State College, Pullman, Wash., from Feb. 1-5, 1954.

The annual program, sponsored by the National Association of Corrosion Engineers in cooperation with the Division of Industrial Services at Washington State College, covers five general topics—fundamentals, practical aspects, corrosion mitigation, materials of construction, and environment.

Additional information may be obtained from Prof. E. B. Parker, director of Div. of Industrial Services.

Cast Acrylic Rods

A LICENSE has been granted to Cadillac Plastics Co., 15111 Second Ave., Detroit 3, Mich., by Du Pont to produce cast acrylic rods and tubes by the same process formerly used by Du Pont.

Robert Jacob, president of Cadillac, announces that the manufacturing facilities purchased from Du Pont are now operating at full capacity in the new Cadco plant. Production for the present will be devoted to rods and tubes, with special emphasis on providing a wide range of sizes.

Low Temperature Plasticizers

COMMERCIAL quantities of two low temperature plasticizers for polyvinyl chloride resins are now available from Monsanto Chemical Co.'s Organic Chemicals Div., St. Louis, Mo. The new products are known as Di (2-ethylhexyl) adipate (DOA) and Di-n-octyl, n-decyl phthalate (DNODP).

DOA imparts low temperature flexibility, as well as heat and light stability, and is useful for controlling the viscosity of plastisols. It is also recommended for use in compounds for producing garden hose, film, and fabric coatings, as well as in vinyl plastisols for toys, footwear, and sponge.

DNODP is recognized as an economical quality plasticizer for obtaining low temperature flexibility, low volatility, heat and light stability, and water resistance. It also imparts viscosity characteristics to plastisols and is especially useful in vinyl film and sheeting for upholstery and draperies, in fabric coatings, and in garden hose. DNODP results in upgraded products with good flexibility, permanence, and resistance to soapy and boiling water.

Polyethylene Foam

CELLULAR polyethylene with half the weight and a dielectric constant about half that of regular polyethylene has been developed by Bakelite Co., 260 Madison Ave., New York 16, N. Y. The new material has been extruded at Bakelite's laboratories on various sizes of wire.

In production, polyethylene is expanded to about one-half of its original specific gravity with the aid of a blowing agent which produces a unicellular material—one having unconnected cells.

Besides an extremely low dielectric constant, excellent power factor, and good dielectric strength, cellular polyethylene has high resistance to water penetration. The new cellular polyethylene has made commercially feasible the insulation of antenna lead-in wires for u-h-f and v-h-f television receivers. Economical application of the new ex-

EVEN THE EXPERTS ARE FOOLED OCCASIONALLY

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CHEMICALS

Aluminum Chloride Anhydrous Resublimed, Aluminum Chloride Anhydrous Sublimed, Diallyl Phthalate, Dimethyl Benzyl Alcohol (DMBA), Dimethyl Benzyl Chloride (DMBC), Ethyl Benzyl Chloride (EBC), Methyl Benzyl Alcohol (MBA), Methyl Benzyl Chloride (MBC), o-Dimethyl Benzyl Chloride (o-DMBC), Phosphorus Oxychloride, Phosphorus Trichloride.

OHIO-APEX DIVISION FOOD MACHINERY AND CHEMICAL CORPORATION

NITRO, WEST VIRGINIA

panded material solves an almost insurmountable insulation problem raised by ultra-high frequency television which could not be made commercially profitable with other insulating materials.

Extrusion techniques for the material have been developed satisfactorily in Bakelite's laboratories. During the extrusion process, the polyethylene compound is heated and the desirable cellular structure is obtained by the expansion of the gas formed. With the necessary pressure maintained in the extruder and die to prevent expansion of the gas, the material expands to twice its usual volume immediately after leaving the die. The amount of expansion in cellular polyethylene may be controlled to the exact degree desirable for the application involved.

This new development opens up other commercial applications as yet unexplored, such as its use for flotation equipment. Cellular polyethylene is more buoyant than standard polyethylene; specific gravities are 0.47 and 0.93, respectively. Cellular polyethylene also retains to a large degree the exceptional chemical resistance of polyethylene which makes it impervious to corrosion by salt sea water, most acids, alkalies, and oxidizing agents.

Quality Program

FOURTEEN companies in the plastics industry have united to launch a vinyl film educational program. The first step will be directed at retailers, fabricators, and processors to acquaint them with the new Vinyl Plastic Film Standard and Seal of Quality which has been promulgated by group action of the industry.

In order to give interested people a chance to become familiar with this program and an opportunity to test out its effectiveness before discussing its strong or weak points, the S.P.I. Vinyl Standards Committee asked that the Film, Sheeting, and Coated Fabrics Division Conference be held in March or April 1954 instead of the usual December date. A discussion of this educational program will then be included as a prominent part of the two-day conference. J. Roy Price, merchandising manager of Bakelite Co., is chairman of the Educational Committee.

Plastic and Sponge Rubber

LOW-COST plastic-surfaced sponge rubber aisle runners have been added to the line of rubber and plastic flooring produced by Fremont Rubber Co., Fremont, Ohio.

The new runners, called Frestep, are available in rolls 36 in. wide and 25 yd. long.

EXPANSION

The Dobeckmun Co., 3301 Monroe Ave., Cleveland 13, Ohio, has completed arrangements for the acquisition of **The Floyd A. Holes Co.**, Bedford, Ohio. The purchase price is approximately $275,000 and involves an exchange of stock. Holes plants in Bedford and Madison, Ohio, are equipped with specially designed and engineered laminating and coating machinery.

Thomas F. Dolan, president of Dobeckmun, states that the reason for the purchase is Dobeckmun's growing demand for laminated, coated, and related products. The Holes' facilities are needed to serve present customers and increase the company's volume in known and promising markets.

Operations at the plants in Bedford and Madison will be continued without interruption, with present management retained.

United States Rubber Co. has announced that ground has been broken in Baton Rouge, La., for new production facilities for Kralastic, a resin-rubber plastic developed by its **Naugatuck Chemical Div.** The new facilities, an addition to Naugatuck's plant, will triple the output of Kralastic, according to the company. Operations are expected to start by July 1954.

Atlas Powder Co., Wilmington 99, Del., has broken ground for the company's new administrative headquarters, to be located on a 45-acre tract at the intersection of Concord Pike and New Murphy Rd., Wilmington. The structure, which will cost about $2,700,000, is scheduled for completion early in 1955. It will house the present 400 general office employees and allow for a 50% future expansion in administrative staff.

Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y., announces a $10 million over-all expansion program for the improvement and enlargement of production facilities in all 12 of its domestic plants. **Henry H. Reichhold**, chairman of the board, states that plans will also be formulated for the production and sale of basic chemicals. Such products as phenol, maleic and phthalic anhydride, formaldehyde, and pentaerythritol will be manufactured by RCI to augment its outside purchases.

Inaugurating the program will be a $3 million expansion of RCI's Tuscaloosa, Ala., plant for the annual production of 5 million lb. of pentaerythritol and 30 million lb. of formaldehyde, both components of Reichhold's synthetic resins. One of the major uses of the chemicals will be in alkyd resins for surface coating materials.

Watson-Stillman Fittings Div., H. K. Porter Co., Inc., Roselle, N. J., announces a $250,000 expansion program for plant and manufacturing facilities. The program includes additional land, buildings, and the installation of specially designed automatic machine tools for increased production of forged steel fittings.

The Borden Co.'s Chemical Div., 350 Madison Ave., New York 17, N. Y., has acquired **American Polymer Corp.**, Peabody, Mass. The acquisition includes American Polymer plants in Illiopolis, Ill.; Montreal, Canada; and Sao Paolo, Brazil. All these plants produce resin emulsions and solutions of various types from a number of base monomers. American Polymer does not produce end products, but sells to manufacturers of adhesives, textile chemicals, sizings, paints, and similar items.

William F. Leicester, vice president of Borden and president of the Chemical Div., states: "The move is in line with the division's policy of expansion in the field of basic chemicals. American Polymer will operate as a separate department of our Chemical Div. Strengthened polymerization facilities will enable an

Is the plastics industry tired?

Passionate faith in one's own idea is a familiar phenomenon. But the idea doesn't mean much until other people —and the right kind of people—also get at least reasonably devoted to it.

The Basic Materials Exposition is a powerful new sales idea. Not because we who brought it into being think so, but because a lot of other people do. People who count: your customers, for example. And your competitors—in the plastics industry and in competitive industries. We have documented evidence of what your customers think. And a blue-ribbon list of the companies that have already taken space in the 1954 show tells what your competitors think.

The plastics industry is already represented in the show by great companies that have paced its growth. The baffling thing is that there aren't more. Of all the events that might be calculated to help give plastics deserved acceptance in industry, this exposition surely ought to be supreme. It is the only medium that gives plastics a chance to make direct comparison of claims and performance with competitive materials—first hand to the men who have the decisive voice in the specification and purchase of materials, parts, components!

The plastics industry has its own show. A fine exposition it is, too. We have managed it for the Society of the Plastics Industry since its founding. It serves admirably its *raison d'etre* of providing vital information about the materials, equipment, machines and services of the plastics industry. But it does not serve that unique function which brought the Basic Materials Exposition into being—the direct, personal comparison of hundreds of materials in one place, at one time.

The Basic Materials Exposition is the most important single marketing event that has ever happened in the materials industries. We live in an economy that dictates change, restyling, substitution, new design. Materials are the key to new and better products. And materials must be compared side by side by the men who design and engineer the world's products to enable them to select the best for each product.

The *second* Basic Materials Exposition will be held in Chicago, May 17-20, 1954. It will provide an uncommonly good vehicle for producers of plastics materials and plastic forms and parts to fight the good competitive fight with other materials old and new that have exceedingly eloquent stories to tell about their superiority.

A note to the show's producers, Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N.Y., will bring you complete information.

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increased production of vinyl, butadiene, styrene, and acrylic and methacrylic emulsions."

Present plans call for the opening of an American Polymer sales office in Boston, Mass. Expanded facilities for manufacturing, as well as for research and development, are contemplated for the near future.

Present American Polymer management will remain to operate the department and the present sales force will also continue with the company.

The Borden Chemical Div. also announces that it has concentrated its general research facilities in a new laboratory at 5000 Summerdale Ave., Philadelphia, Pa. The new research laboratory will augment the division's present development and applications laboratories on the East and West Coasts, which specialize in wood gluing, fir plywood and hardboard adhesives, and plastic molding compounds.

David F. Gould is in charge of the laboratory and will be assisted by **Thomas J. McNaughton.**

COMPANY NOTES

Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y., announces the following appointments in the Plastics Div.: **C. M. Reynolds** has been named assistant director of sales of the film department. **Peter J. Dunn** replaces Mr. Reynolds as assistant district manager of the Midwest sales territory. **Loring E. Harkness, Jr.** is now chief industrial engineer. His former affiliations were with Dan River Mills, Inc. and Aluminum Co. of America. **Paul Conaway** has joined the division as a sales representative in the Midwest district, with headquarters at 1514 Merchandise Mart, Chicago, Ill. He was formerly associated with Reynolds Metals Co.

Catalin Corp. of America, 1 Park Ave., New York 16, N. Y., announces that **August Napravnik,** previously with the organization for 10 years, has rejoined the technical staff as manager of the New Products Div. For the past few years Mr. Napravnik had been in charge of resin research and development at the Bainbridge, N. Y., laboratory of **The Borden Co.'s Chemical Div.** In conjunction with his duties as manager of the New Products Div., Mr. Napravnik will conduct market research concerning proposed new products and act as field technical adviser in their introduction to the plastic and chemical industries.

The company also reports that **Rice M. Minor, Jr.** and **Louis Drucker** have joined its laboratory staff at the Fords, N. J., plant.

Nu-Mfg. Co., 1359 W. North Ave., Chicago, Ill., has opened a new plant for the manufacture of plastic molds and tools. The plant will operate under the name of **Florida Mold & Tool Corp.** at 603 Pinellas St., Clearwater, Fla.

Romar Plastics, Inc., 1311 E. Main St., St. Charles, Ill., is a new organization in the field of thermosetting molding. New equipment, presses from 100 to 250 tons with transfer rams, as well as complete engineering and mold-making facilities, are available to manufacturers requiring molded parts. Thermoplastic equipment will be available soon after the first of the year. **William A. Hart,** president of Romar, has been associated with the plastics industry in the Chicago area for the past 25 years.

The Pantasote Co., 26 Jefferson St., Passaic, N. J., has acquired a new and larger warehouse at 2291 English St., High Point, N. C. The warehouse will carry complete stocks of all vinyl upholstery materials, in addition to showroom facilities. **William Bennett** is district sales manager in charge of the warehouse.

B.I.P. Engineering, Ltd., Streetly, Staffs., England, has appointed **Ralph B. Symons Associates, Inc.,** 3571 Main Rd., Tiverton, R. I., to represent them in the United States. The Symons organization will set up a complete showroom of B.I.P. pelleters and automatic molding presses and will maintain a stock of spare parts for the servicing of the British equipment. They will also render complete service on the presses, both from a maintenance and an application point of view.

Heyden Chemical Corp., 342 Madison Ave., New York 17, N. Y., has opened a new sales office in the Paramount Bldg., 920 McMillan St., Cincinnati, Ohio. **T. H. Risch,** formerly from Heyden's Chicago branch office, will head the Cincinnati office. The company also announces the appointment of **Robert M. Aude** as manager of its Fords, N. J., plant. Mr. Aude was formerly affiliated with Monsanto Chemical Co. for 14 years.

Knickerbocker Plastic Co., Inc. is now located at 11501 Hart St., P. O. Box 3996, Victory Center, N. Hollywood, Calif.

Gering Products, Inc., N. Seventh St. & Monroe Ave, Kenilworth, N. J., announces the following appointments: **Thomas I. O'Connor** has been named sales manager of the Compounding Div.; **Harry F. Eels,** sales manager of the Garden Hose Div.; **James D. Oakley,** sales manager of the Export Div.; **Leon Papier,** traffic manager; and **M. Joseph Malik,** purchasing agent.

The Dow Chemical Co., Midland, Mich., announces that **Donald L. Gibb,** manager of plastics sales, has been elected a director of **The Saran Yarns Co.,** Odenton, Md., a firm jointly owned by Dow and The National Plastic Products Co., Odenton. Mr. Gibb succeeds **Carl A. Gerstacker,** Dow treasurer and director, who retains his position as treasurer of Saran Yarns.

Dow also announces personnel changes and the establishment of three new sections in its plastics technical service department as follows: **Paul Lipke,** former head of the special products section, has been appointed section head of the new technical service formulation laboratory; **J. W. Mighton,** formerly in charge of the mechanical portion of the testing section, is now head of the new sheeting section and will handle development work in vacuum forming of such plastic parts as TV masks and refrigerator liners; **Maurice Q. Tessin,** formerly with the textile section, has been named to a new post as staff coordinator of field development work and technical service on polyethylene, for which a plant is now under construction at

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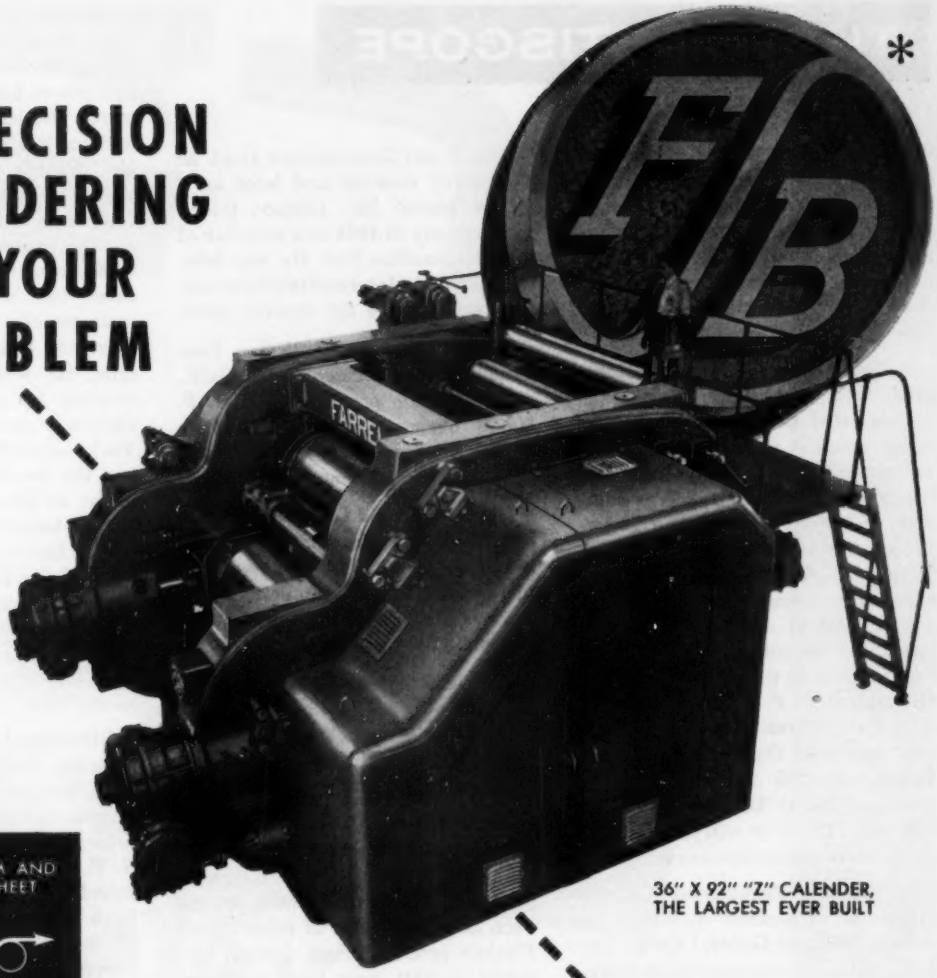

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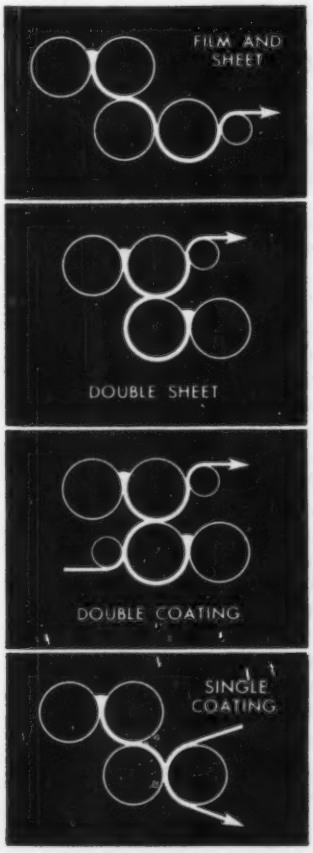

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the Texas Div.; **Robert E. Monica,** formerly with the extrusion section, has been placed in charge of the new calendering section for the development of polyvinyl chloride plastics into flexible sheeting material for shower curtains, upholstery, luggage covering, and various other products.

National Research Corp., 70 Memorial Dr., Cambridge, Mass., announces that **R. A. Knight** has been made assistant sales manager of its Equipment Div. Mr. Knight was formerly associated with M.I.T. as manager of the Aeroelastic and Structures Research Laboratory and with Dewey & Almy Chemical Co. in sales engineering and sales supervision. **Carl W. Hermann** has been appointed exclusive representative for the division in 11 Western states. His address is P. O. Box 1170, Palo Alto, Calif. **Byron Ellis,** Chicago representative of the division, is now located at 8226 N. Ozanam Ave., Chicago (Niles) 31, Ill., from which address, Mr. Ellis will continue to serve Midwestern customers.

Livingstone Engineering Co., 100 Grove St., Worcester 5, Mass., has named **Midwest General Corp.,** Detroit, Mich., as exclusive sales representative and field engineers for the state of Michigan.

Hooker Electrochemical Co., 14 Union St., Niagara Falls, N. Y., announces that **Joseph J. Constantino** has joined the company as a design engineer, **Jacob B. Hufford** as a chemical engineer in the process study group, and **Frank W. Long** as a chemist in the plastics and resins group in the research and development department.

Detroit Plastic Fixture Co. has moved to a new and modern building at 26083 Groesbeck Highway, Roseville, Mich.

National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., announces that **Dr. Leon W. Seigle** and **Fred B. Johnson** have been appointed manager and assistant manager, respectively, of Intermediate Sales of the division. Since joining the company in 1939, Dr. Seigle has served in the Research and Development Dept. as a research chemist and later as a section leader. Mr. Johnson joined the company in 1934 as a member of the Merchandise Div. He was later transferred to Intermediate Sales and has served there for several years.

Modglin Co., Inc., 3235 San Fernando Rd., Los Angeles 65, Calif., announces the promotions of **D. P. Hayes** to general manager and **Mark G. Simpson** to factory manager and assistant general manager.

Ohio Sealer and Chemical Corp. is a newly formed organization located in Brookville, Ohio. The company manufactures vinyl compounds and finishes, plastisols, adhesives, and strippable coatings.

Textileather Corp., 607 Madison Ave., Toledo 3, Ohio, has appointed **Paul S. Ridley** as chief plant engineer and **James W. Brady** as chief industrial engineer.

Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., announces the following appointments: **Carleton Ellis, Jr.** has been named director of sales for all Plaskon products; **Sam Gurley,** formerly Barrett resin sales manager, is now general sales manager; **H. W. DeVore** has been appointed manager of molding compound sales; **H. A. Raymond, Jr.,** manager of industrial sales; **C. D. Delaney,** manager of coating resin sales; and **Robert K. White,** advertising manager for Plaskon plastics and resins.

Atlas Powder Co., Wilmington 99, Del., reports the following appointments: **Howard W. Dellard** has been named head of the company's Chicago chemical district sales office. Mr. Dellard succeeds **Harry B. Paul,** who has been transferred to Wilmington to direct chemical district sales there. **William H. Erwin** is now international division director of the industrial chemicals department. Mr. Erwin was formerly head of chemical sales.

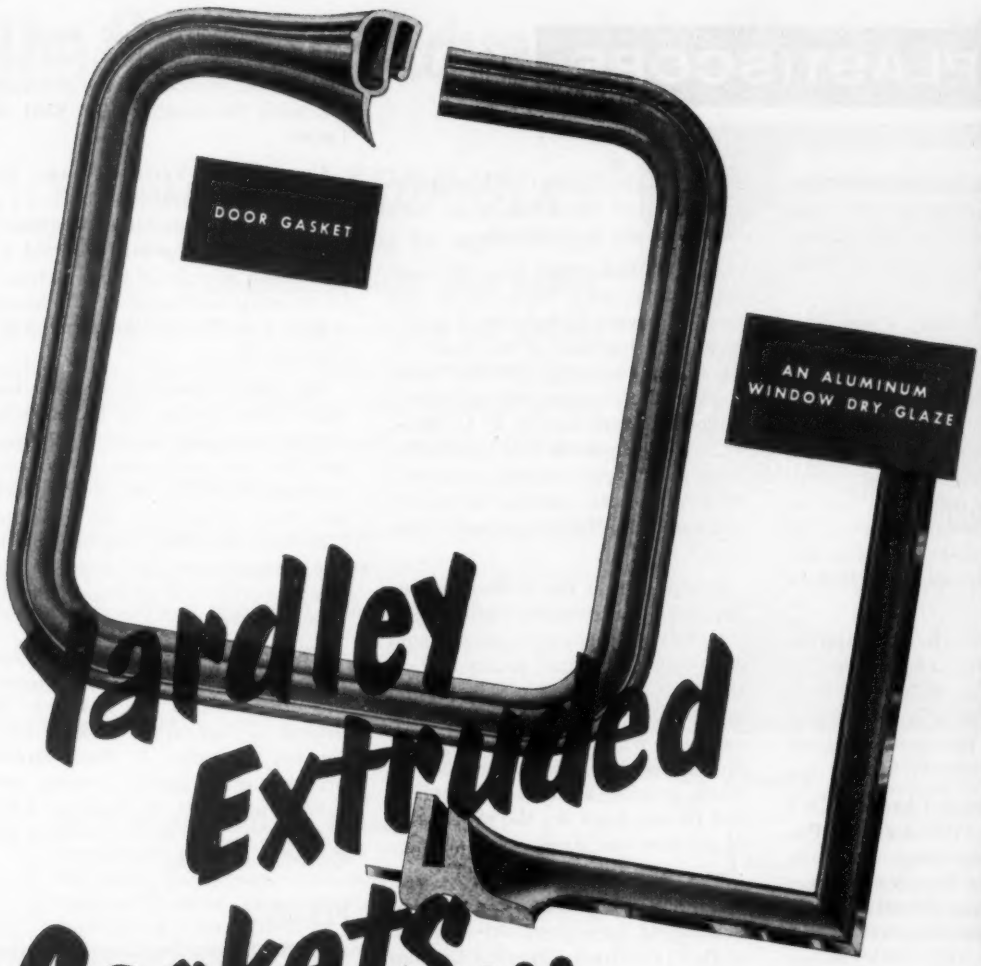
F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa., announces that **Quentin M. White,** manager of sales and development of plastics molding equipment, will also head sales and development of Stokes-Windsor plastics extruding equipment. **Edward Fitzpatrick,** formerly plastics engineer with International Resistance Corp., has joined Mr. White's staff and will be in charge of sales development of the company's thermosetting plastics molding equipment. **Samuel H. Greenwood,** formerly manager of extruded sales, has been appointed district manager of a newly enlarged territory with headquarters in Philadelphia. He will supervise sales and services for all Stokes products in eastern Pennsylvania, upstate New York, lower New Jersey, Delaware, and the southeastern United States as far as Florida. The district office is maintained as a separate unit at Stokes headquarters. **Walter E. Rayher** and **Joe D. Robertson** will assist Mr. Greenwood. **Larry Morehouse** and **Fred Hillsley** have joined the sales staff. **Harry A. Walp, Jr.,** senior sales engineer, has been transferred to the New York district office.

Givaudan-Delawanna, Inc., and its associate companies, **Givaudan Flavors, Inc.** and **Sindar Corp.,** have moved from their Atlanta, Ga., office to larger quarters at 1156 Dalton Dr., N. E. Givaudan-Delawanna and its associate companies in Detroit, Mich., have also opened new and larger offices at 18228 Mack Ave. **R. M. Stevenson** will manage the office.

Nopco Chemical Co., Harrison, N. J., has purchased the controlling interest of **Yocum Faust, Ltd.,** London, Ont. The subsidiary will continue to operate under its own name. This addition gives Nopco facilities for production and distribution in Canada of its widely diversified line of industrial processing chemicals and vitamin products. From its three current plants in Harrison, N. J., Richmond, Calif., and Cedartown, Ga., Nopco supplies over 300 chemical specialties, including emulsifiers, lubricants, plasticizers, sizes, and detergents.

Robert F. McClellan has been appointed vice president and general manager of Yocum Faust. Mr. McClellan was formerly Midwest district manager of Nopco for 11 years, with headquarters in Chicago, Ill.

Ferro Chemical Corp., Box 349, Bedford, Ohio, has appointed **C. Withington Co.,** 29-28 Forty-first Ave., Long Island City 1, N. Y., as



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its sales agent for metropolitan New York, western Connecticut, and northern New Jersey. Warehouse stocks will be carried in Long Island City and Newark, N. J.

National Vulcanized Fibre Co., Wilmington, Del., announces the promotion of **Harry C. Hackett** to staff sales manager and **James O. Otis** to sales manager. Mr. Hackett has been with the company since 1912. He will continue in his duties as president of National Vulcanized Fibre Co. of Canada, and assistant secretary of National Vulcanized Fibre Co. Mr. Otis joined the company in 1934 as a sales engineer.

Bjorksten Research Laboratories, Inc., Madison, Wis., announces that **William S. Fiedler, Robert R. Walters, Robert E. Wedemeyer, Robert G. Splies,** and **Elizabeth Bergenn** have joined its research staff.

Pittsburgh Coke & Chemical Co.'s Plasticizer Div., Pittsburgh 19, Pa., announces the appointment of **Duncan J. MacLennan** as sales manager of the division and **James F. Hall, Jr.** as sales representative in the Pittsburgh area. Mr. MacLennan was formerly associated with Whitney Chain Co., Hartford, Conn., and Godfrey L. Cabot Co., Inc., Boston, Mass.

United States Rubber Co., 2638 N. Pulaski Rd., Chicago 39, Ill., has appointed **B. F. Webster** and **D. A. Perritt** as sales engineers for Royalite plastic products. Mr. Webster will cover the New England states and Mr. Perritt, the Southwestern territory.

Hardesty Chemical Div., W. C. Hardesty Co., Inc., 41 E. 42nd St., New York 17, N. Y., has completed an addition to its plant for the production of its dioctyl phthalate type plasticizer, Harflex 500.

Thor Enterprises, Inc., P. O. Box 123, Gladstone, N.J., has been formed to do custom vacuum forming of thermoplastic sheeting.

General American Transportation Corp. announces that its New York offices are now located on the entire 23rd floor of the new 380 Madison Avenue building. Eastern headquarters for all of the divisions are also located at the new address.

Acheson Industries, Inc., 420 Lexington Ave., New York, N. Y., re-elected **Howard A. Acheson** as president and chairman of the board at its annual meeting. At the same meeting the company also appointed **Raymond Szymanowitz, P. C. Buck,** and **M. W. Reynolds** vice presidents; **John C. Sprague,** secretary-treasurer; **Leatha Tuer,** assistant secretary; and **Lester H. Miller,** assistant treasurer.

Precision Tool, Die & Machine Co., Inc., 1435 S. Shelby St., Louisville 4, Ky., has set up an injection mold department for the production of single cavity experimental molds and multi-cavity production molds. The company will also do experimental molding and production molding of small articles. **Richard A. Flanigan** and **George Lenz** are the proprietors of the new operation.

The B. F. Goodrich Co., Akron, Ohio, announces that **Dr. Frank K. Schoenfeld,** vice president-technical of **B. F. Goodrich Chemical Co.,** has been elected vice president-research of the parent company. Dr. Schoenfeld has been with the organization since 1927 and replaces **Dr. Howard E. Fritz,** who has retired. **Harry B. Warner,** plant manager of BFG Chemical's Avon Lake, Ohio, Experimental Station, succeeds Dr. Schoenfeld as vice president-technical. Mr. Warner, who joined the company in 1939, will make his headquarters in Cleveland.

Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N. J., has elected **J. Harry DuBois,** vice president, engineering, a director of the corporation. Mr. DuBois' election fills the vacancy left by the recent retirement of **James L. Robertson,** director, after 22 years of service.

Loven Chemical of California, Inc., 244 Pine St., Newhall, Calif., announces that plans are under way for the construction of a phenol and a formaldehyde plant, with capacities of 10 million lb. each. Building will start when architectural and technical plans are completed. **Harry C. Millerburg,** executive vice president, was elected president of the company following the death of **Dr. Karl A. Loven.**

Consolidated Vacuum Corp., 735 Ridge Rd., W., Rochester 3, N. Y., a subsidiary of **Consolidated Engineering Corp.,** has appointed **Gerald C. Waterman** as regional sales manager for the midwestern states, with headquarters at 919 N. Michigan Ave., Chicago, Ill.

The Quaker Oats Co., Merchandise Mart Plaza, Chicago 54, Ill., has sold engineering and operating know-how for the production of furfural to South Porto Rico Sugar Co., which will build a plant at La Romana, Dominican Republic, and develop its own management and sales policy. The company will produce furfural from bagasse.

Visking Corp., 65th St. and Oak Park Ave., Chicago, Ill., announces the appointment of **Bernard H. Schenk** as president of **Visking, Ltd.,** Lindsay, Ontario. **J. Paul Smith,** president of the parent company and former president of Visking, Ltd., is now chairman of the board of the Canadian company.

PERSONAL

H. K. Phinney has been appointed manager of the **Laminating Materials Div. of Bakelite Co., a Div. of Union Carbide and Carbon Corp.,** 260 Madison Ave., New York 16, N. Y. Mr. Phinney succeeds **Harry Carlson** who was recently appointed to the Market Development Dept.

Dr. F. Otto Haas has been elected executive vice president of **Rohm & Haas Co.,** Washington Sq., Philadelphia 5, Pa. He joined the company in 1939 as a research chemist. For the past two years, his major activities have been in the chemicals and plastics sales division. He has been a director of Rohm & Haas since 1948 and in 1951 was named a vice president and member of the executive committee of the board of directors.

Fred B. Shaw has been named director of Conolite research of **Continental Can Co., Inc.,** 100 E. 42nd St., New York 17, N. Y. His headquarters will be at the company's decorative and industrial laminated plastics plant in Milwaukee, Wis. Mr. Shaw

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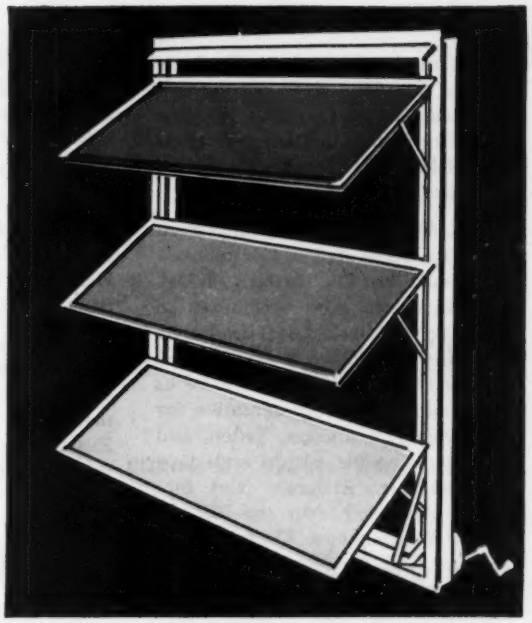
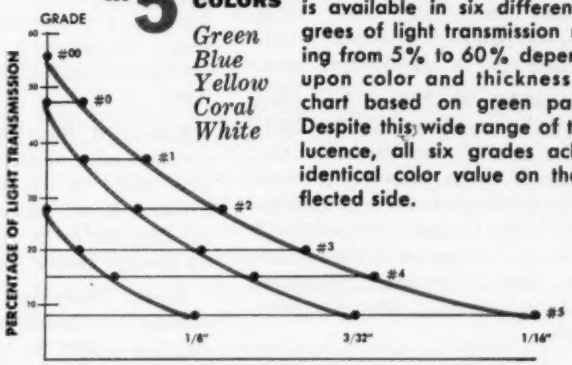


GRADATION TROPIGLAS is the new and safe glazing material for industrial, commercial and residential use. Made of reinforced fiber glass, it possesses all of the strength, dimensional stability and impact resistance inherent in such material.

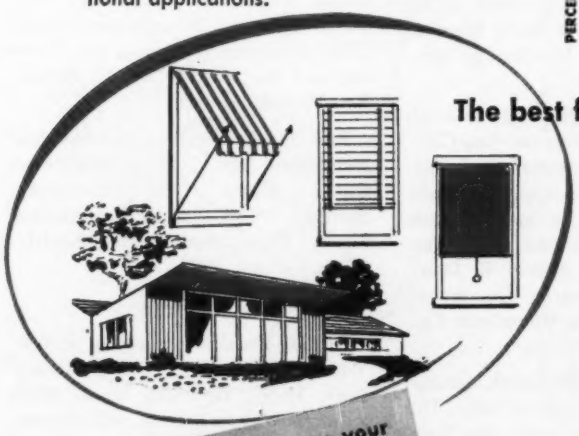
Of far greater importance is the system of GRADATION which we have incorporated in TROPIGLAS to elimininate harsh rays of light that penetrate ordinary glass . . .to bring soft, pleasant light to any interior in the degree that you desire . . . to spread the light over a larger area thereby putting it to greater use.

for factories, offices, stores, schools, hospitals, public buildings and homes
No other glazing material can offer the advantages of GRADATION TROPIGAS in new buildings or as replacement for regular window panes in modernized structures. In addition, it is being used extensively for hurricane and storm windows, translucent coverings for patios and breezeways, windbreaks, illuminated signs, decorative partitions and for many other functional applications.

in 5 COLORS
Green
Blue
Yellow
Coral
White



Each of the five attractive colors is available in six different degrees of light transmission ranging from 5% to 60% depending upon color and thickness (see chart based on green panels). Despite this wide range of translucence, all six grades achieve identical color value on the reflected side.



The best features of ALL these products are combined in GRADATION *TROPIGLAS*

This new product is a combination of all these mechanical devices. Installed in awning-type windows for example, GRADATION TROPIGLAS serves as an awning when open, a venetian blind open or closed, a glare deflector by inbuilt characteristic and a shade at all times. IMAGINE . . . one product serves all these purposes.

Write us today on your letterhead. We will send you samples, descriptive folder and prices.

Russell **REINFORCED PLASTICS CORP.**
Manufacturers of *Repco Plastics*
WEST HOFFMAN AVENUE, LINDENHURST, L. I., N. Y.
Lindenhurst 5-1700

*T. M. Reg.

was formerly chief of the Products Div. of the United States Army's Chemical Corps, and prior to that was associated with **Libbey-Owens-Ford Glass Co.**, Toledo, Ohio, and Chrysler Corp., Detroit, Mich.

O. E. Anderson has been appointed to the technical staff of **Continental-Diamond Fibre Co.**, Newark 29, Del. Mr. Anderson, who specializes in materials used in electrical insulation, including laminated plastics and flexible coated fabrics, will serve as technical service representative for the company's silicone, Teflon, and polyester flexible sheet and tape products. Mr. Anderson was formerly associated with the **Micarta Div. of Westinghouse Electric Corp.**, Trafford, Pa., for 24 years.

Richard H. Garnett, new textile sales engineer of **Glass Fibers, Inc.**, Toledo 2, Ohio, with offices in the Chrysler East Bldg., New York, N. Y., will handle the company's textile accounts in the Eastern area.

Alexander E. Kleine has been named sales representative for lightweight film of **The Pantasote Co.**, Passaic, N. J. Mr. Kleine will make his headquarters at 935 Merchandise Mart Plaza, Chicago, Ill., and will service the territories of Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

R. Louis Rougemont, formerly chief engineer of **Reed-Prentice Co.**, has been retained by **Jackson & Church Co.**, Saginaw, Mich., as consulting engineer for its plastics division.

Alexander Moore has been appointed to the Development and Service Dept. of **Emery Industries, Inc.**, 4300 Carew Tower, Cincinnati 2, Ohio. He will be associated with both the development of new products and technical service on Emery's complete line of fatty acids, plasticizers, and textile products.

Allan Stephens has been appointed special assistant in the industrial sales division of **Resin Industries, Inc.**, Santa Barbara, Calif. His assignments will include the preparation of technical sales data on all Resinite insulation tubing and sleeving and supervision of sales promotional activities.

George P. Wertz has been named district manager of **Alsynite Co. of America**, 4654 De Soto St., San Diego, Calif., with offices in the Hartman Theatre Bldg., 81 E. State St., Columbus, Ohio.

F. R. Kiernan is now works manager of **Kurz-Kasch, Inc.**, Dayton 1, Ohio, plastics molders. As a commander in the United States Naval Reserve during World War II, he was an industrial engineer in the Bureau of Ordnance; since then he has had six years' experience in the plastics molding business.

Felix W. Saco has been promoted to development engineer of **The Permutit Co.**, 330 W. 42nd St., New York 36, N. Y. The company manufactures ion exchange resins and water conditioning apparatus for commercial and industrial applications.

Robert M. Sax has been named assistant sales manager of industrial glass sales of the **Textiglass Div., Cheney Bros.**, Manchester, Conn. Mr. Sax was formerly affiliated with St. George Textile Corp.

Frank Gustafson is now sales manager of **Columbia Basin Plastics Co., Inc., 1900** S. W. Harbor Dr., Portland 1, Ore.

John K. Wise, assistant director of research of **U. S. Gypsum Co.**, Chicago, Ill., has been elected chairman of the American Chemical Society's Div. of Paint, Plastics, and Printing Ink Chemistry for a one-year term. Mr. Wise succeeds **Arthur K. Doolittle**, assistant research director of **Carbide and Carbon Chemicals Co.**, South Charleston, W. Va.

George Edward Holbrook, assistant director, Development Dept., Du Pont, was presented with the Professional Progress Award by the American Institute of Chemical Engineers for his remarkable record as a chemical engineer in his successive positions of directing research, development, and plant production of organic chemicals, as well as his public services in advancing the profession of chemical engineering.

Sponsored by **Celanese Corp. of America** and managed by the Institute, the award, which carries a grant of $1000, is presented annually at the Awards Banquet at the Institute's annual meeting, held this year in St. Louis, Mo., December 13-16.

Peter R. McClure has joined the staff of the research and technical laboratories of the **Plasticizer Div., Godfrey L. Cabot, Inc.**, 38 Memorial Dr., Cambridge, Mass. Mr. McClure will primarily be engaged in the solution of specific customer technical problems.

James E. Baskin, former project engineer on the technical staff of the **Fiber Glass Div., Libbey-Owens-Ford Glass Co.**, at Parkersburg, W. Va., has been named district sales manager of a new office at 912 Enquirer Bldg., Cincinnati, Ohio.

MEETINGS

Jan. 14-21—National Housewares Manufacturers Assn., 20th National Housewares and Home Appliance Exhibit, Navy Pier, Chicago, Ill.

Jan. 25-28—Plant Maintenance and Engineering Conference and Show, International Amphitheatre, Chicago, Ill.

Jan. 31-Feb. 3—Western Merchandise Exhibitors Assn., Western China, Glass, Gift, Jewelry, Toy, Stationery, and Housewares Show, Civic Auditorium, Palace, St. Francis, and Sir Francis Drake Hotels, San Francisco, Calif.

Feb. 14-17—Western Merchandise Exhibitors Assn., Pacific Northwest China, Glass, Gift, Stationery, Jewelry, Toy, and Housewares Show, Civic Auditorium, Seattle, Wash.

S.P.E. Meetings

Jan. 13—Combined meeting of New York and Newark chapters, Military Park Hotel, Newark, N. J. First speaker, Wayne Pribble, will discuss "Mold Design—Profit or Loss?" Second speaker, Dr. M. Bigelow, will talk on "Reinforced Plastics."

Jan. 26-28—Tenth S. P. E. Annual Technical Conference, Royal York Hotel, Toronto, Canada.

NEW... from Monsanto

for casters, coaters, slush molders

OPALON 410

Stir-in vinyl plastisol resin

Developed especially for coating, casting and slush-mold applications, Monsanto's new Opalon 410 plastisol resin offers an exceptionally wide range of *outstanding* properties you can use to advantage.

It is an extremely versatile resin of absolute uniformity . . . with low viscosity and good dispersion. It can be stirred into other components in a high-speed mixer . . . needs no solvent addition . . . requires no grinding.

Among the many superior properties added by Opalon 410, there are:

1. **High strength, and abrasion and wear resistance**
2. **Resistance to grease, water and most detergents**
3. **Resistance to oxidation and discoloration by sunlight**
4. **Good flexibility at low temperatures**

Whatever your coated, cast or slush-molded product, it will pay you to investigate Opalon 410 resin. For full information on this new plastisol for your product, write: MONSANTO CHEMICAL COMPANY, Plastics Division, Room 2601, Springfield 2, Mass. Opalon: Reg. U. S. Pat. Off.

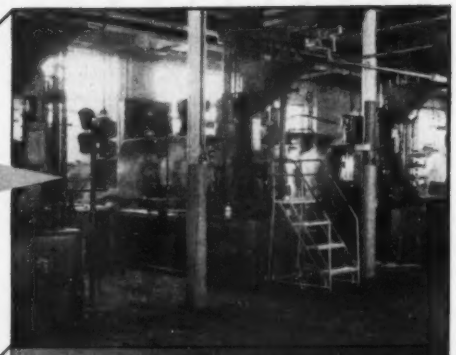
MONSANTO

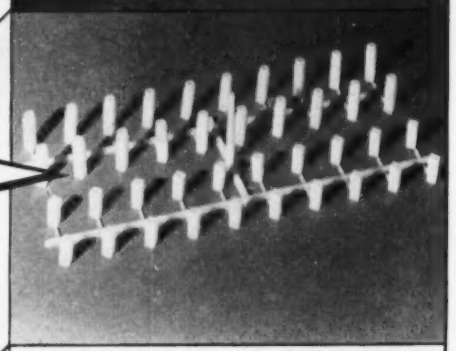
SERVING INDUSTRY . . . WHICH SERVES MANKIND

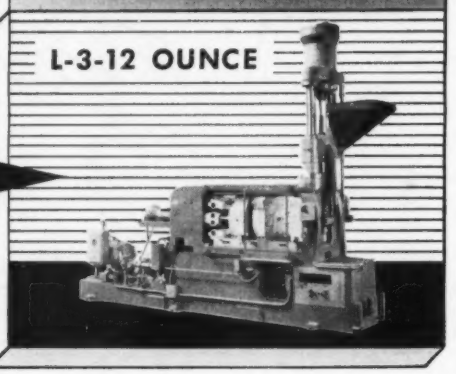
DANIELSON MANUFACTURING COMPANY

100% NYLON

100% LESTER







Up in Danielson, Connecticut, there's a plant where they mold nylon—and nothing but nylon. Day in, day out and all day long they mold nylon. And what do they mold it on? A battery of Lesters!

In 1946, Danielson Mfg. Co., started molding nylon on their first machine. Since that time, Danco has used Lesters exclusively to handle every kind of nylon problem that has turned up.

In the photo above you can see a typically fine shot currently in production—a gate of 40 nylon bearings used on a cotton picker. The clean, sharp end of the sprue is mute testimony to the effectiveness of the Lester Nylon Cut-off Attachment. And for vocal testimony here's what Danco says, "We've had such good results with Lesters, we've made them a standard for our molding equipment. That's why we have three more Lesters on order."

May we send you complete specifications on the Lester Injection Molding Machine to suit your molding requirements?

LESTER INJECTION MOLDING MACHINES

REPRESENTATIVES

New York . . . . . Steven F. Krould
Detroit . . . . . Thoreson-McCosh
Chicago . . . . . J. J. Schmidt
Cleveland . . . . . Don Williams
Coral Gables . Morton Machinery Sales
Seattle . Perine Machinery & Supply Co., Inc.
Cincinnati . . . . . Index Machinery Corp.
Los Angeles . . . Seaboard Machinery Co.
San Francisco . . . . . J. Fraser Rae
St. Louis, Milwaukee . . . . . A. B. Geers
Providence . . . . . Sydney W. Lohman

FOREIGN

Toronto, Canada . . . Modern Tool Works, Ltd.
Sydney, Australia . . . Scott & Holladay, Ltd.
Japan . . . . . Okura & Co., New York, Inc.

distributed by LESTER-PHOENIX, INC., 2621-R CHURCH AVENUE • CLEVELAND 13, OHIO

Detroit Plastic Tile Repeats the Lester Tile Record!

1600 Perfect Tile Every Hour! from a 20 oz. LESTER...

The 20 ounce Lester is, without any question, the most economical machine built for molding tile. Here are the facts to substantiate this claim:

At Detroit Plastic Tile Co., they're molding 1600 pieces per hour (and we're talking about the standard .065 thick, 4-1/4 x 4-1/4 deluxe wall tile). The best 8 oz. machine we've ever seen will mold about 900 pieces per hour of this tile. Assuming labor costs to be equal, but including an increased cost for power consumption with the larger machine, this 1600 to 900 ratio represents a reduction in cost per tile of over $6.00 per day.

However, here are the really startling figures: That extra 700 tiles is 87 sq. ft. Using the average molder's selling price and multiplying these figures by a 24 hour day, you've got $417.60. Allowing only a modest 8% profit, you've got $33.41 per day, plus the $6.00 saving in production. Figure a 300 day working year and you've got a resounding $11,823!

Now, the 20 ounce Lester costs up to $10,000 more than an 8 oz. machine. You can see that you would have the cost differential returned in little more than 10 months and then the machine would be earning an *extra* $1000 per month!

And this doesn't take into account the equally important saving effected through holding wall thicknesses to size, practical elimination of rejects, and reduction of down-time.

To quote Mr. Alonzo Tripp, president of Detroit Plastic Tile: "We're tickled pink with the way the Lester has been working for us. We never realized that our tile costs could be so low."

LESTER INJECTION MOLDING MACHINES

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Detroit . . . . . Thoreson-McCosh
Chicago . . . . . J. J. Schmidt
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Seattle . Perine Machinery & Supply Co., Inc.
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St. Louis, Milwaukee . . . . A. B. Geers
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Japan . . . . Okura & Co., New York, Inc.

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CLASSIFIED ADVERTISEMENTS

MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

HYDRAULIC PRESSES: 1—Birdsboro, 2000 tons, down-acting ram 34" dia. x 14" stroke, 48" DLO, 42" x 42" bed area. 1—Clearing, 500/1500 tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 393 tons, 48" x 48" steam platens, 2 openings, 4 rams—10" dia. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 tons, down-acting ram 11½" x 9½" x 6" stroke, 22" x 20" bed, 24" DLO, self-contained, 15 HP MD Vickers Pump. Unit PRACTICALLY NEW. 1—Watson-Stillman, 100 tons, 11¾" x 12" platens, 22½" DLO, ram 8" dia. x 15" stroke, complete with 3 HP MD Pump. 1—HPM, 100 tons, 18" x 18" Platen Area, ram 8" dia. x 18" stroke, 30" DLO, Steel Cylinder—4000 PSI. 2—Burroughs, 75 tons, down-acting, 17½" x 17" electric-heated platens, 13½" DLO, ram—8" dia. x 10" stroke, complete with 7½ HP MD Oilgear Pump. 1—HPM, 35 tons, down-acting ram 6" dia. x 6" stroke, 15" DLO, 12" x 6" bed area, self-contained. 1—Induscо Laboratory Press, 12 tons, Hand Operated, 8" x 8" electrically heated platens. NEW. 3—Denison, 4 tons, Model FH4-CO1, down-acting ram—3¼" x 2" x 12" stroke, 18" DLO, bed 22" x 14", 8⅛" throat, complete with 3 HP MD Pump, time delay control, all valves, piping, gauges, controls. 1 machine slightly used, 2 units still in original crates. 1—Standard Machinery Co. #14 Toggle Press, 150 tons, platen area 34" x 28", 6" DLO, 3½" Stroke, arranged for Motor Drive, practically new. ALSO: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Tel.: Bigelow 8-2500. What have you for sale? What are you looking for?

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 New R. D. Wood 500 ton EMBOSSING PRESSES: 54"x26" platen: HYDRAULIC PRESSES: 42"x37", 20" ram, 475 tons; 2-7 opening 27"x27", 18" ram, 565 tons; 24"x24" 12" ram, 170 tons; 24"x20" 10" ram, 118 tons; 20"x20" 10" ram, 118 tons; 20"x20" 10" ram, 200 tons; 30"x20" 8" ram, 75 tons; 24"x20" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 15"x15" 8" ram, 75 tons; 2-19"x24" 10" rams, 78 tons; 12"x12" 6½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x 9½" 4½" ram, 20 tons; 16"x16" 3½" rams, 12 tons; PREFORM PRESS: Colton 5½T, Reeves Drive and Motor; LABORATORY PRESSES: Carver & Watson Stillman Units; NEW UNIVERSAL DUAL PUMPING UNITS: 3-15 HP; NEW LABORATORY MILLS, and CALENDERS; EXTRUDER; Modern Plastic 1½"; ACCUMULATOR; HPM 6" ram 2500#, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York 13, N. Y.

FOR SALE: 32 ounce Watson-Stillman, new. 32 ounce Reed-Prentice, new 1950. 28 ounce Watson-Stillman. 24 ounce DeMattia. 22 ounce Impco vertical. 22 ounce Reed-Prentice, new 1948. 20 ounce Lester. 16 ounce Reed-Prentice, new 1946. 16 ounce H.P.M., 1946, $15,000. 12 ounce Lester. 12 ounce Reed-Prentice, new 1950, will accept terms. 12 ounce Watson-Stillman, new 1953. 9 ounce H.P.M., 1946. 8 ounce DeMattia, 1946, $7500. 6 ounce Lester, Model 1½L & 4 ounce Lester, both $11,500. 4 ounce Reed-Prentice, new 1945. 4 ounce Lester. 3 ounce Fellows, new. 2 ounce Fellows, 1951. 2 ounce DeMattia vert. hydraulic, $1,000. G.E. Dielectric Preheater; vacuum plater 4' cap.; 300 ton French Oil self-contained hydr. compression press; 200 ton Stokes; 150 ton Stokes; 60 ton Watson; 50 ton Stokes automatic, Model 235-A; #½ Cumberland scrap grinder 5 HP; (2) Brosite 5 tray ovens, $125, each. ACME MACHINERY & MFG. CO., 102 Grove St., Worcester, Mass.

FOR SALE AT GREAT SAVINGS Colton 2RP and 3RP Rotary and 4T Tablet Machines. Day 40x120 Single Deck Sifter. Great Western—all models. Mikro Bantam, 1SH, 2TH, 3W, 3TH, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, double Arm from 12 to 150 gal. Mixers. (Unidor and Vacuum also) J. H. Day, from 4 up to 75 gal., Imperial and Cincinnatus, D. A. Jacketed, Sigma Blade Mixers. Day & Robison Dry Powder Mixers, 100 up to 10,000 lbs. Package Machy, FA, FA4, Miller Hayssen 3-7 Scandia auto, Wrappers. Hudson Sharp Campbell auto. Cellophane Wrapper. REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements. UNION STANDARD EQUIPMENT CO. 318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Rubber and Plastic Equipment. Farrell 16" x 48", 15" x 36" and 6" x 12", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. W.S. 300 ton downstroke Hydr. Press, 30" x 30" Platens self contained. 350 ton 22" x 24". New Loomis 340 ton, 24" x 56" platens. Southwark 325 ton, 42" x 24" platens. Adamson 200 ton, 24" x 24" platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 150 ton 30" x 60". 100 ton 24" x 24". Elmes 75 ton 36" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE: 1—6"x12" Lab. Roller Mill; 2—Thropp 16"x40" and Farrell 15"x36" Mills; 1—Reed-Prentice 4 oz. Model 10A Injection Molding Machine; 1—No. 1 Banbury Mixer; 1—3 Roll Vaughan Calender 18"x54"; 7 Dry Mixing Blenders up to 5,000 lbs; 3—Micro Pulverizers; 2—Ball & Jewell Cutters; 6—18"x18" Hydraulic Presses; 1—Kux Model 50 Preform Machine; 1—Day Ro-Ball No. 71 S/S sifter. Also Grinders, Extruders, Pulverizers, Baker Perkins Mixers, Screens, Kettles, etc. Send us your inquiries. We buy your idle machinery. CONSOLIDATED PRODUCTS CO., INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N.Y. Tel: BArclay 7-0600.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: Practically New 50 ton Reinforced Plastics Press 36" x 24" with 36" stroke, complete with Hydraulic Unit. Also matched steel mold for tool or tackle box, cored for steam. On West Coast. Reply Box 1310, Modern Plastics.

BRAND NEW 32 oz. Watson-Stillman Plastic Injection Molding Machine, never used. FOR SALE AT SUBSTANTIAL SAVINGS. Machine will carry a new machine guarantee. Owner retiring. Reply Box 1317, Modern Plastics.

FOR SALE: Injection Presses: 24 oz., 12 oz., 8 oz., Reeds: 4 oz., 9 oz., 16 oz., HPM, 4 oz. Makray, 1 oz. Van Dorn. Extruder: 1½" NRM. Scrapgrinders, Ovens. Laboratory Presses. Compression Presses. Pumps. 1—Stokes automatic 50 tons 235A. Stokes 280C Preformpress. 42" Slitting Machine. Complete Wire coating unit. 3 HP Gasboilers. List your equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

STOKES ROTARY PELLET PRESSES (5): 16-punch RD-3 and 15-punch RDS-3. (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #1½ stainless steel rotary cutter. Mikro Pulverizers #1-SH, #1-SI, #2-TH, #2-SI & 24". Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Philadelphia 22, Pa.

FOR SALE: POLYVINYL ACETATE UNIT, capacity 1000# per hour. Includes, 500 gal. s/s Reaction Kettle with Condensers and Xpl motor; 6' dia. x 15' long s/s, d.h. Rotary Resin Dryer; solid bowl type, all s/s Centrifuge, 30" x 40", m.d.; 3—s/s Tanks, 500 gal., 250 gal.; 3—s/s Pumps with Xpl motors. Equipment is NEW, entirely of 316 stainless. Priced at fraction of new cost. Drawings available. CONSOLIDATED PRODUCTS CO. INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N.Y. Tel: BArclay 7-0600.

FOR SALE: Razor blade slitting and winding machine 54" with double take-up bars, friction clutches throughout—$675.00. Expandable drum machine motorized for table cloths and shower curtains 54" expands from 36" to 112" with interleafing paper take up and slitting bar—$595.00. T & M MACHINE & TOOL CO., 29 Greenpoint Avenue, Brooklyn 22, N. Y. Tel: EVergreen 9-1964.

FOR SALE: Injection Molding machines, 1—60 oz. Compression Molding presses, 15—750 tons. Extruders, 1—¼", 4—½". Hydraulic Pumps, all sizes. Grinders, 5 HP—50 HP. Boilers 10—250 HP. Ovens, all sizes. Plastic machinery Bought & Sold. EVEREADY SUPPLY CO., 895 Housatonic Ave., Bridgeport, Conn. Tel. 4-9471. E. J. McCallum.

FOR SALE: High pressure steam boiler, made by Livinston Engineering Co. Model 700, Series 11/2, maximum pressure 249 PSI. Excellent condition, complete with Speedyvent, fittings, and flexible metal high pressure hose. Fob Rochester, New York. Make offer. Reply Box 1309, Modern Plastics.

NEW EXCEPTIONAL Available: new and latest type calender by Berstorff (Germany) with all automatic controls—4 rolls 24" x 62" variable speed—140 HP electric motor. Weight 55 tons—built for all kinds of rubber and plastics industries. M. DRON, Pantin (France).

FOR SALE: 1—10" x 20" 2-roll plastics mill, M.D. 1—Paterson 8' conical blender, 5000#, M.D. 5—Stokes 50 and 100 ton compression molding presses, self-contained. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand Street, NYC 13, WO 4-8130.

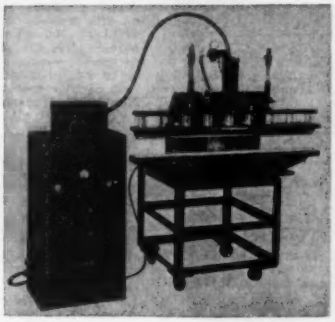
HYDRAULIC PRESSES rebuilt, repaired. Used presses from laboratory to 1000 tons standard and special, molding and hobbing presses etc. Used pumping units up to 10,000 p.s.i. all capacities. CLIFTON HYDRAULIC PRESS CO., 291 Alwood Rd. P.O. Box 325, Clifton, New Jersey.

FOR SALE: 4—Rebuilt 4-color print machines, 60" face x 60" diameter impression cylinder. Perfect condition. Excellent for printing Vinyl, Acetate, Oil Cloth or Textiles. Can also be converted to 6-colors. LEMBO MACHINE WORKS, INC., 248 East 17th Street, Paterson, N. J.

(*Continued on page 222*)

For L-O-N-G Seals
You Can't Beat This
MAYFLOWER 2-POSTER

Here's a press for high speed production on those long straight seals for raincoat facings, curtain headings and plastic inflatables. Powered by the 2½kw Mayflower generator, it has a giant spread of 60" and may even be had up to 84". Early delivery assured.



Mayflower MAKES HARD JOBS Easy!

Your specific problems become the specialty of our engineers and production experts the moment you call us . . . (Union 3-7100)

Mayflower ELECTRONIC DEVICES Inc.

Only Manufacturer of both Bar and Rotary Electronic Heat Sealers

UNion 3-7100

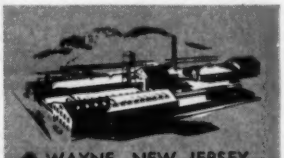
6014 Hudson Blvd. West New York, N. J.

Plastic Reamers Molded for Westinghouse Electric Fruit Juicer Include Metal Shaft Inserts
Stethoscope Part Produced for Becton, Dickinson and Company, Makers of Medical and Surgical Instruments.
MACK
custom-molded components
Chicken Inoculation Needle Made for Lederle Laboratories Division of the American Cyanamid Company
DESIGN
MOLDING
MOLD MAKING

—INCLUDING

precision molded parts

FROM 3 COMPLETE PLANTS



● WAYNE, NEW JERSEY

● ARLINGTON, VERMONT

● WATERLOO, P. Q. CAN

Specify Mack with confidence for all plastic molding requirements. One of the original plastic molders, Mack experience dates back over three decades to the beginning of the industry. From design to final inspection, Mack Molding methods are keyed to meet industry's varied needs. Complete service—from blueprint to finish—features deliveries to meet assembly line schedules. Inquiries will receive prompt attention; address Mack Molding Company, Inc., Wayne, New Jersey.

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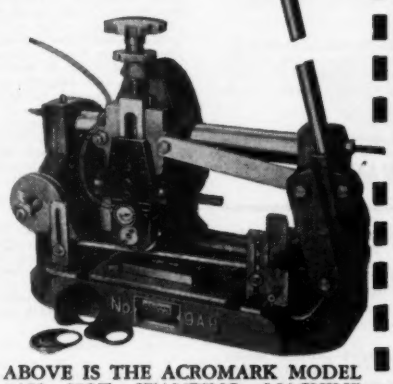
MOLDED EXCELLENCE

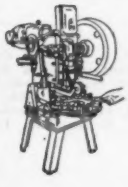
OVER 30 YEARS OF MOLDING SERVICE TO INDUSTRY

ACROMARK MEANS "ACCURATE MARKING"

MARK PLASTICS

BY THE PROCESS THAT SUITS THE JOB





ABOVE IS THE ACROMARK MODEL 9AH HOT STAMPING MACHINE WHICH ALSO COMES IN MOTOR DRIVEN AND AIR DRIVEN MODELS.

This is — The ACROMARK Model 2AH Power Press Hot Stamping Outfit.

The ACROMARK Company

5-15 Morrell St.

Elizabeth 4, New Jersey

CLASSIFIED ADVERTISING

(*Continued from page 220*)

TWO 28-oz. WATSON-STILLMAN Injection Molding Machines for sale. Built 1947 & 1948, complete with 28-oz. and 32-oz. cylinders. Can be inspected in production. Write Box 1301, Modern Plastics.

MACHINERY and EQUIPMENT WANTED

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., Observer Highway, Cor. Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel: BArclay 7-0600.

WANTED: One injection molding machine of 4 and 8 oz. capacity, in excellent condition and early delivery. Kindly give price and description in your first letter. Reply Box 1307, Modern Plastics.

WANTED: 16 oz. injection press. Reed Prentice 1950 or later. Must be in good condition and operating. Will only consider press that can be seen running. State price, terms, serial and model number and list all accessories. Reply Box 1323, Modern Plastics.

WANTED: Used Stokes Model T pilling machine. Good operating condition, complete with motor. Reply Box 1325, Modern Plastics.

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N.Y.

MATERIALS FOR SALE

VINYL EXTRUDERS
& COMPOUNDERS
We Offer You A Steady Supply Of: Natural, Colorless Vinyl Granules; Grey Reprocessed Vinyl Pellets; White Reprocessed Vinyl Pellets. ALSO Green & Brown Virgin Spot Lots Of Sizeable Quantities.
CLAUDE P. BAMBERGER, INC.
152 Centre Street B'klyn 31, N. Y.
Tel: Main 5-5553
Not connected with any other firm of similar name.

WILL SELL SUBSTANTIALLY BELOW SCHEDULE in original drums—Prime Quality 10,000 lbs. AB11-2 Velsicol 10,000 lbs. 70% Liquid Sorbitol 5,000 lbs. Carbide Bks 90 Polystyrene Emulsion 4000 lbs. Carbide Plasticizer Tws 10,000 lbs. Corn Products Zein. Reply Box 1331, Modern Plastics.

POLYETHYLENE OFFERED — NATURAL VIRGIN CRYSTALS. Manufacturers original packing and put up. DYNH 3 (Bakelite) or ALATHON 10 (Du Pont) Prompt shipment from holding Warehouse inventory. Prices commensurate with market at all times. THE CLEMENTS COMPANY, 125 S. Front Street, Phila. 6, Pa. Tel: MArket 7-7122.

AVAILABLE MONTHLY SUPPLY
Approximately 30,000 lbs. Vinyl Scrap Slabs. Year round proposition.
Reply Box 1326, Modern Plastics.

FOR SALE: PVA SHEET—659 pounds, Reynolon #4301 in 10 inch wide rolls in original packages. Also 800 pounds Strux (cellular cellulose acetate) 3/4" x 6" x 15 feet. Both priced to sell. Write LONE STAR BOAT MANUFACTURING COMPANY, P.O. Box 698, Grand Prairie, Texas.

POLYETHYLENE—Scrap and Virgin, bought and sold. BLANE CORPORATION, Canton, Mass.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WE ARE ALWAYS IN THE MARKET FOR THERMOPLASTIC SCRAP AND REJECTS OF ALL KINDS. Also surplus or obsolete lots of reprocessed and virgin materials purchased. Highest prices paid. Custom grinding and compounding to your specifications. PLASTIC MATERIALS, INC., 589 Main Street, Westbury, L.I., N.Y. DIAL—WEstbury 7-7124.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: PLASTIC SCRAP IN ANY FORM. Rejects—Nozzle Waste—Surplus Inventories, Obsolete Virgin Molding Powders—Acetate, Butyrate, Ethyl Cellulose, Hi Impact, Nylon, Polyethylene, Polystyrene, Vinyl, Acrylic. Highest Prices Paid. We also reclaim your scrap. Consult us for Reprocessing Charges. GERING PRODUCTS, INC., 7th St., Kenilworth, N.J. Cranford 6-2900.

WANTED: RESINS for High and Low Pressure Laminating. We are building laminating plants in Brazil and Argentina and would like to contact U.S. sources of supply for resins and raw materials used in the high and low pressure plastics laminating field. Reply Box 1333, Modern Plastics.

MOLDS FOR SALE

FOR SALE—Injection Molds to produce the following items: Flat Pocket Cigarette Case—Piano style Cigarette Box— Table style Cigarette Box—Round Pancake style Compact—and 4 Miniature Automobiles. All these molds practically new and priced at less than one-third original cost and a fraction of present reproduction costs. For information, write NOSCO PLASTICS, INC., Box 269, Erie, Penna.

FOR SALE: Poker Chip Molds Interlocking Designs—60 and 100 Cavity Compression Molds, sample chips upon request. EAGLE ELECTRIC MFG. CO., 23-10 Bridge Plaza South, L. I. City 1, N. Y.

MOLDS WANTED

WANTED: Plastics Injection Molding Die for Thermo-Plastic Doll 16" to 21" high. Please send sample and full particulars in first letter. AVSCO, INCORPORATED, 940 Isley Boulevard, Excelsior Springs, Missouri.

DESIRE PURCHASE Lipstick Holder Molds for 8-12 ounce injection Molding Machines. Send full particulars and price desired. Reply Box 1313, Modern Plastics.

WANTED—Injection Mold for "Toy Scissors." Please send samples and all details concerning the mold to: MAKRAY MFG. CO., 1419 Diversey Pkwy., Chicago 14, Illinois.

WANTED: MOLD or MOLDER to make 1/2" to 5/8" plastic beads, with hole in center. Large quantities needed. NOVELTY TRIMMING WORKS, 18 East 16th Street, New York 3, N. Y. Tel.: AL 5-7548.

PLANTS FOR SALE

FOR SALE: Complete Injection Molding Plant (building not included) consisting of 2 Reed-Prentice 10-D-10 machines purchased 1950-51, 2 Watson-Stillman 32 oz. machines purchased 1953, complete with dies to manufacture housewares products which represent leading items on the market. Plant has minimum potential of $1,000,000 sales. Present operations approximately $500,000 sales. Here is an opportunity to place yourself in an established business or to augment your present lines for only the cost of the machinery. Owner retiring. Reply Box 1318, Modern Plastics.

PLANT AVAILABLE 7,000 sq. feet mfg. space heated and sprinklered. Additional space available if needed. Concrete floor, fluorescent lights, wired for heavy power, watchman service, ample trained labor. Located metropolitan Boston. Offer attractive proposition to progressive extruder using vinyl and/or polyethylene scrap. Reply Box 1316, Modern Plastics.

HELP WANTED

CHEMISTS AND CHEMICAL ENGINEERS FOR RESEARCH, PILOT PLANT, SALES SERVICE. Outstanding opportunities to grow with an expanding petro-chemical company well known for its progressive policies. Applicants should have background in polymerization and/or plastic applications. Experience with polyethylene preferred. Location: Mid-Illinois.
NATIONAL PETRO-CHEMICALS CORPORATION
120 Broadway, New York 5, N. Y.

TECHNICAL SERVICE REPRESENTATIVE: Well established chemical company offers real opportunity to chemist for technical service on vinyl resins. Eastern location. Employee benefits. Bonus. Salary open. Send full details, photo. Replies kept confidential. Reply Box 1306, Modern Plastics.

POLYESTER PRODUCTION MAN:—If you have experience in the fabrication of Polyester resins we can offer a partnership and/or a profit sharing arrangement in a new large scale operation without any investment by you. To qualify, a thorough know how of all phases of production with current experience in the actual fabrication and production of corrugated sheets, auto bodies, etc., is required. A technical background is preferred but not essential. We will also consider a technical service man who is engaged in development work in the manufacture and use of polyester resins. Write giving details which will be held in the strictest confidence to the JOHN BROKERAGE ASSOCIATES CO., Rooms 303-306, 400 38th Street, Union City, New Jersey.

MECHANIC: Hard Hitting, familiar with Polyethylene bag machines & able to devise, install & improvise equipment to step-up production & meet changing demands. Challenging opportunity & excellent salary with established eastern mfr. Box 280, REALSERVICE, 110 West 34th St., N. Y. C.

WANTED: Young Chemist or Chemical Engineer with experience in reinforced fiber glass to join development group in plant of growing, established manufacturer. Location Midwest. Send details of background, experience, salary, etc. Replies confidential. Reply Box 1304, Modern Plastics.

POLYESTER RESIN CHEMIST thoroughly experienced product development and plant production preferably with sales contacts. Salary plus profit participation basis. Reply Box 1332, Modern Plastics.

(*Continued on page 224*)

Companies

you can trust

... trust Norton

● Whenever Richard Hudnut wants molded plastics for their products, it is almost habitual for them to call on Norton. Since 1940 Norton has been molding many different cases and compacts which bear the famous Hudnut name. In many instances, as with this chic black lipstick-powder duo, Norton does a major share of the assembly and decoration.

Nationally-known users of injection and compression molding know they can rely on Norton for earth-bound pricing, prompt deliveries, reliable engineering, and cooperative service. That's the only way Norton knows how to do business.

Norton Laboratories, Inc., Lockport, New York. Sales Offices: New York—175 Fifth Avenue; Chicago—5221 Kimbark Avenue; Cleveland—20605 Kings Highway; Detroit—3-167 General Motors Building.

NORTON *Laboratories, Inc.*

CLASSIFIED ADVERTISING

(*Continued from page 222*)

TECHNICAL MANAGER—Profit sharing plan available when ability proved. Unusual opportunity with Division of well established medium size company. Experience in plastics not essential, but desirable. We produce polyester laminates and do thermoplastic fabrication. Desirable applicant would have experience in either chemical, aircraft or plastics industry, and would have served in technical or supervisory capacity in any of the following: process engineering, development, design, tooling or technical service. Some production experience is desirable, but not essential. Will be responsible for necessary planning and development of manufacturing procedures and quality and process standards and controls. Operations located in mid-west. Replies confidential. Furnish salary requirements and summary of personal, education, and experience data. Reply Box 1314, Modern Plastics.

MOLDING SUPERINTENDENT
Established New England manufacturer planning to expand its plastic molding department needs a qualified production superintendent for this department. Experience in injection molding with knowledge of equipment, molds, and materials plus supervisory experience are essential. Preferably experienced in all types of molding including compression and vacuum forming. Reply Box 1329, Modern Plastics.

SALES ENGINEERS to represent old-established injection molder. Press capacity 4 to 200 ounces. Tool room, painting, silk screening, hot stamping—all conveyorized. Straightline assembly. Automatic packaging equipment. Prefer experienced men and men with industrial contacts. Also men controlling one or more special deals. Large midwest plant. Give complete details. Personal interview to follow. Reply Box 1303, Modern Plastics.

REINFORCED PLASTIC ENGINEER-FOREMAN. To assume responsibility for operation engaged in matched metal molding of proprietary product. We manufacture and market established product. Experience in other techniques helpful for further development of other products. Established company in Ohio. Good opportunity for right man. Salary open. Reply Box 1308, Modern Plastics.

PRODUCTION SUPERINTENDENT:
Old established firm expanding into new fields can offer a challenging opportunity to a man with a good production background in low-pressure reinforced plastics. This man must be a capable administrator who knows how to direct people effectively. He must have extensive experience with small preformed parts made of polyester resins reinforced with fiberglas mats, and be familiar with preform equipment and presses used in mass production methods. Knowledge of and experience with honeycomb sandwich and foamed-in-place laminates is desirable. An Engineering background is preferred but not essential.
We can offer a good starting salary, security, and an opportunity for growth and expansion. For further information send details of your education, work experience and starting salary requirements to Box 1311, Modern Plastics.

RESIN SALES. Could use one more good man. Full line Urea, Phenolic Resins—Liquid or Powder types. All correspondence treated in confidence. Address Reply to SALES MGR., c/o P.O. Box 1768, Wilmington, Delaware.

PLASTIC SUPERINTENDENT. We want a top man experienced in all phases of Injection Molding—assume full charge of foreman, production, quality control etc. Supervise machine maintenance. Must be good organizer and leader and capable of getting the best results from his assistants. Unusual opportunity with large established Chicago Molder. Reply in confidence to Company President. Salary open plus profit sharing. Reply Box 1300, Modern Plastics.

SITUATIONS WANTED

MANAGEMENT DEVELOPMENT-TRAINING-PERSONNEL-EXECUTIVE with plastics specialization available soon. Do your foremen need improvement of their supervisory skills? Your employees need sharpening of technical skills and attitudes? Your executives benefit from management development programs? (When morale is high, production costs drop! !) Age 44, college education, with considerable experience in organization and manpower development through comprehensive industrial relations. Reply Box 1321, Modern Plastics.

YOUNG MAN, 29, HARVARD COLLEGE graduate, Economics-Chemistry, Columbia University M.A., 4 years sales promotion and advertising experience, 3 years government service, wishes position with progressive plastics manufacturer offering good future. Excellent references. Reply Box 1330, Modern Plastics.

COST MINDED PLASTIC MANUFACTURING SPECIALIST thoroughly familiar with all equipment and techniques used in compression, injection and transfer molding, desires to contact company presently buying plastics parts but interested in forming separate corp. to reduce costs. Presently located east coast but would locate anywhere. Will put up dollar for dollar with interested parties. Available after June 15th. Reply Box 1328, Modern Plastics.

REINFORCED PLASTICS ENGINEER: Chemical Engineer, 29, energetic, personable. Five years product engineering and sales engineering experience industrial plastics. Thorough knowledge tooling and production procedures, wet lay-up, bag mold, and matched die phases. Currently responsible for engineering and sales of reinforced plastic products for large national organization. Desires permanent engineering-sales position with smaller, solid, aggressive company. Reply Box 1319, Modern Plastics.

SALES AGENTS WANTED

SALES REPRESENTATIVES WANTED: for several territories, to handle successful line of Reinforced Plastic molding materials and compounds. Send resumé giving background and qualifications. Outline territory and industries covered, also products you are presently handling. Reply Box 1327, Modern Plastics.

ARE YOU AN ESTABLISHED, aggressive sales representative with experience in thermoplastics? If you are, and are willing to take on an additional line, write us, giving details. We are one of the largest custom extrusion companies making rods, tubes, and shapes to specifications. Our record of fulfilling delivery promises and of setting new standards on things regarded impossible by others, will help you with prospects in any industry. Reply Box 1305, Modern Plastics.

SALES REPRESENTATIVE WANTED by expanding midwest molder for Chicago area. Capacity to 200 tons compression and transfer. Other territories available. Plant located near Chicago. Prefer man with established connections. This is an excellent opportunity for individual with injection account. Commission. We specialize in industrial and close tolerance molding. Reply Box 1324, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Reply Box 1302, Modern Plastics.

MISCELLANEOUS

WELL ESTABLISHED TEXTILE & CHEMICALS MANUFACTURER with large well-equipped factory, all services, situated in Industrial North of England, wishes to contact progressive American Company who is desirous of expanding its business by means of Licensing or Royalty agreements. Reply in first instance to Box No. L. 4653, INTAM LIMITED, 14 Half Moon Street, London, W.1., England.

FOR SALE: ACETATE, white, ivory, pink pastels, red, blue and green, at 28c per pound, F.O.B. New York, regular supply. Odd colors 23c. 16 OUNCE IMPCO Injection Machine, without press, $5000.00.
WANTED: a 350 ton Toggle Press.
PEERLESS CHEMICAL CORP.
181 Greene Street, N. Y. C. 12.

OPPORTUNITY for Injection Moulding Firm connected with toy trade or persons considering establishing Injection Moulding Firm. World famous British manufacturers with range of original toy item moulds available for capacities 1 oz., 3 oz., 4 oz., 6 oz. and 8-10 oz. wishes interest in American Firm requiring lines. Write enclosing catalogue of present manufacturers or proposals. Reply Box 1315, Modern Plastics.

WANTED: High and Low Pressure Laminators. We are building laminating plants in Brazil and Argentina and seek technical assistance and "Know-How" plus some financial assistance from a U.S. company engaged in this enterprise. Project to be done on a royalty basis. Reply Box 1334, Modern Plastics.

ATTENTION: INJECTION MOLDERS. If you have proprietory injection molds of Housewares, Toys, Notions, Novelties, I can market your products to major Chain Stores and Jobbers. Backed by 20 years experience in the plastic field, I can give you national distribution and volume sales on commission basis. I maintain a New York display room and have an extensive following. Reply Box 1335, Modern Plastics.

BRITISH EXECUTIVE with extensive experience of plastics industry, and with available capital seeks contact with U.S. company with a view to co-operation and manufacture in England. Vacuum forming and embossing of particular interest but proposals from any other branch of plastics industry will be considered. Reply Box 1322, Modern Plastics.

PATENTED PLASTIC ELECTRICAL Household necessity, new idea, big volume seller thru chain stores and to electrical appliance manufacturers, every home needs 12 with a yearly replacement of three, prevents fires caused by wiring shorts, meets with underwriters approval, retails for around 75 cents, reasonable mold cost, good profits, for sale or license. Send replies to: E. M. KENNEDY, 1648 East 77th Street, Cleveland, Ohio.

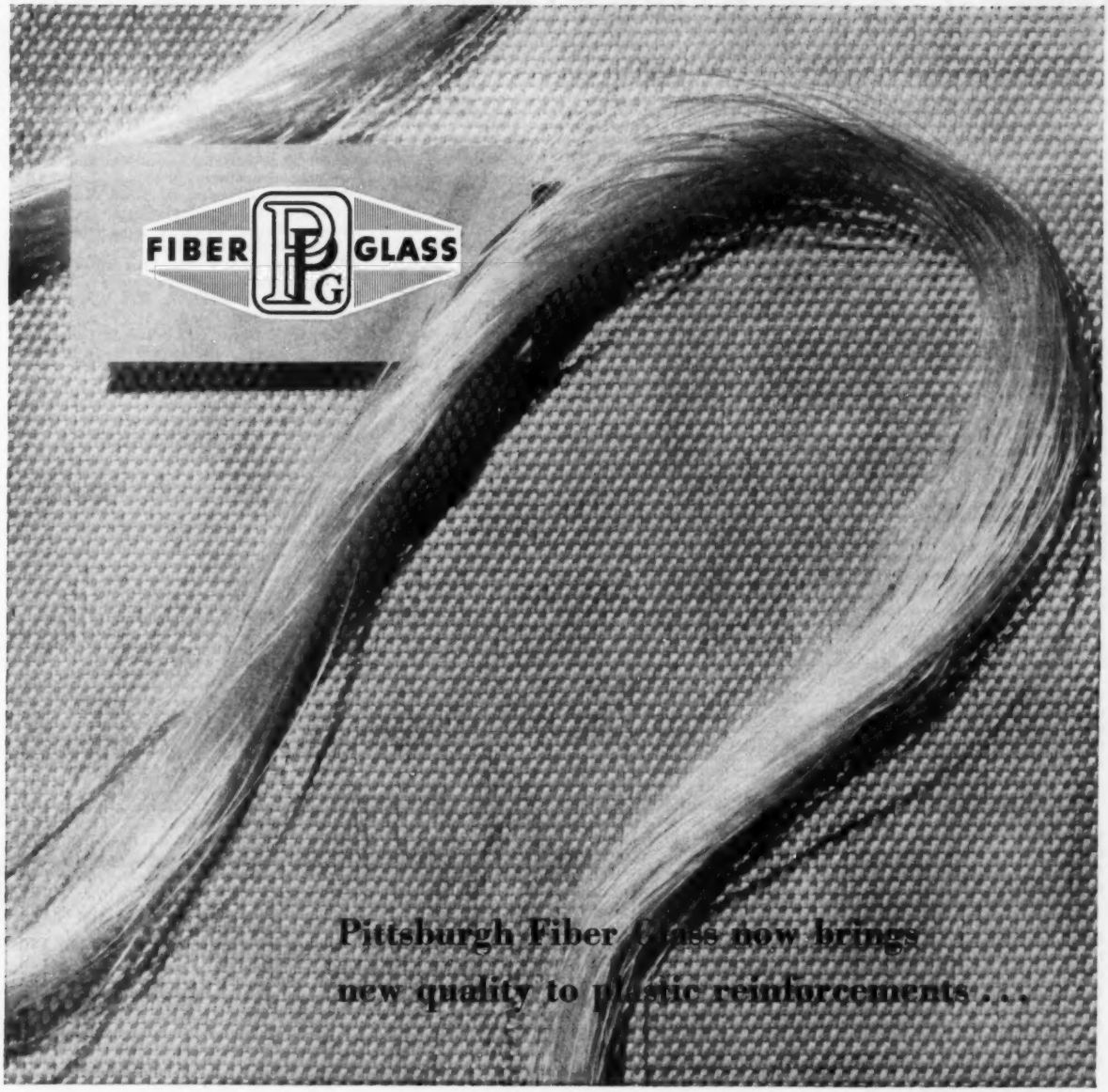
GERMAN CHEMICAL WORKS (1200 employees) wants to contact U.S. manufacturer of REINFORCED PLASTICS for the purpose of obtaining license or making some other arrangement for building up together the manufacturing of these products in Germany. Preferable: Preforming system or corrugated resp. flat sheets. Reply Box 1320, Modern Plastics.

AUSTRALIAN MANUFACTURING COMPANY interested in contacting American group, specializing in production of polyesterglass fiber sheets, with view to cooperation and manufacture in Australia. Capital available. Would pay expenses of expert to come to Australia on contract. Reply Box 1312, Modern Plastics.

All classified advertisements payable in advance of publication
Closing date: 28th of the second preceding month, e.g., December 28th for February issue.

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.



You'll find that Pittsburgh Fiber Glass is importantly *different* for reinforcing your plastic products—a difference that means easier fabrication and better laminating results.

Key to this new quality is found in the way we make fiber glass at the nation's newest fiber glass plant in Shelbyville, Indiana. Here, over 70 years "know-how" in glassmaking has been applied to insure continuous filament fiber of exceptionally uniform diameter and quality in manufacture. Roving is packaged with a uniform tension that improves automatic feeding in preforming operations. Reinforcing cloth woven of Pittsburgh yarns is made to the specifications required for best performance in laminates.

Why not test Pittsburgh Fiber Glass on your own production runs soon? Complete information on Pittsburgh yarns, roving and chopped strand—or the names of weavers supplying cloth made with Pittsburgh yarns—can be obtained from our executive offices or district sales offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER GLASS **PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS**

PITTSBURGH PLATE GLASS COMPANY

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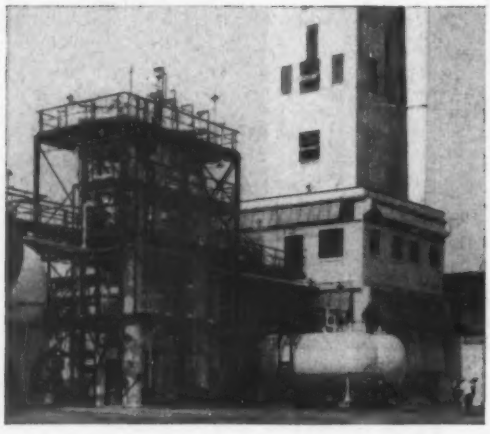

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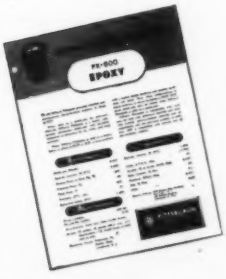

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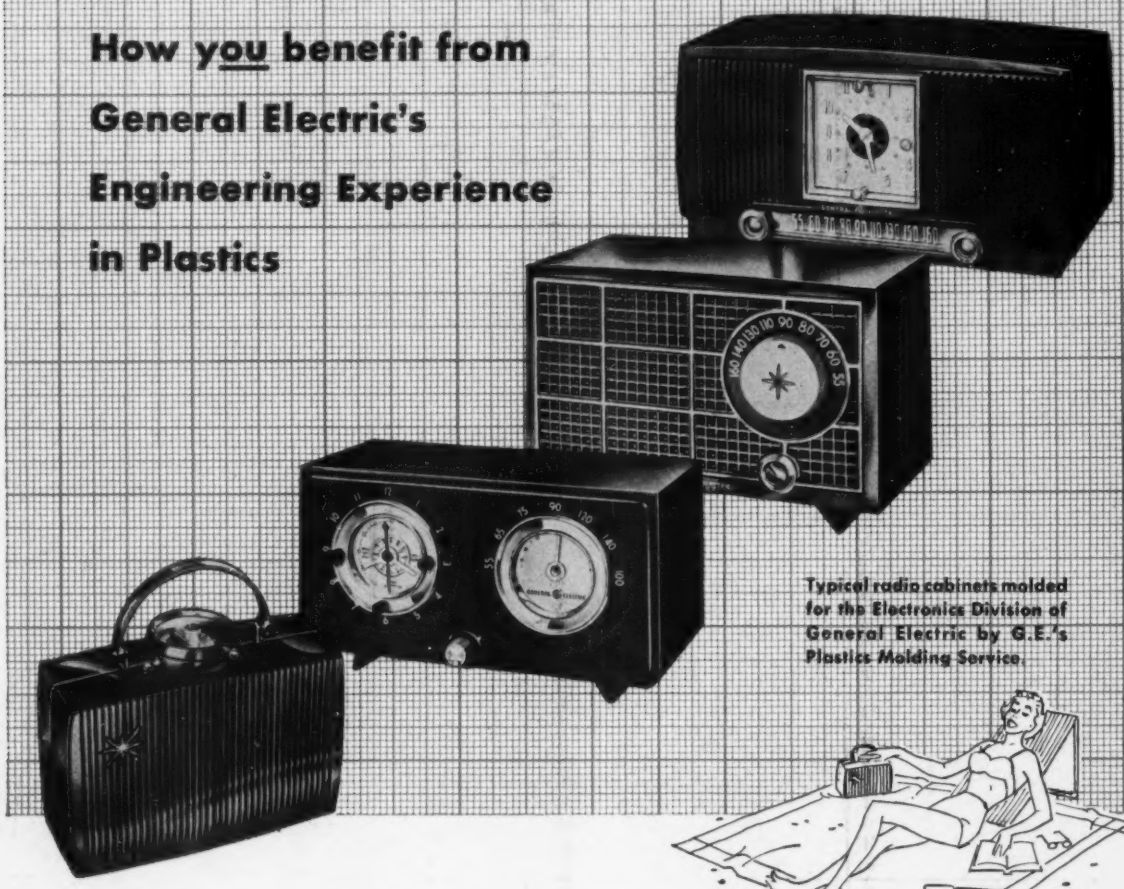

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